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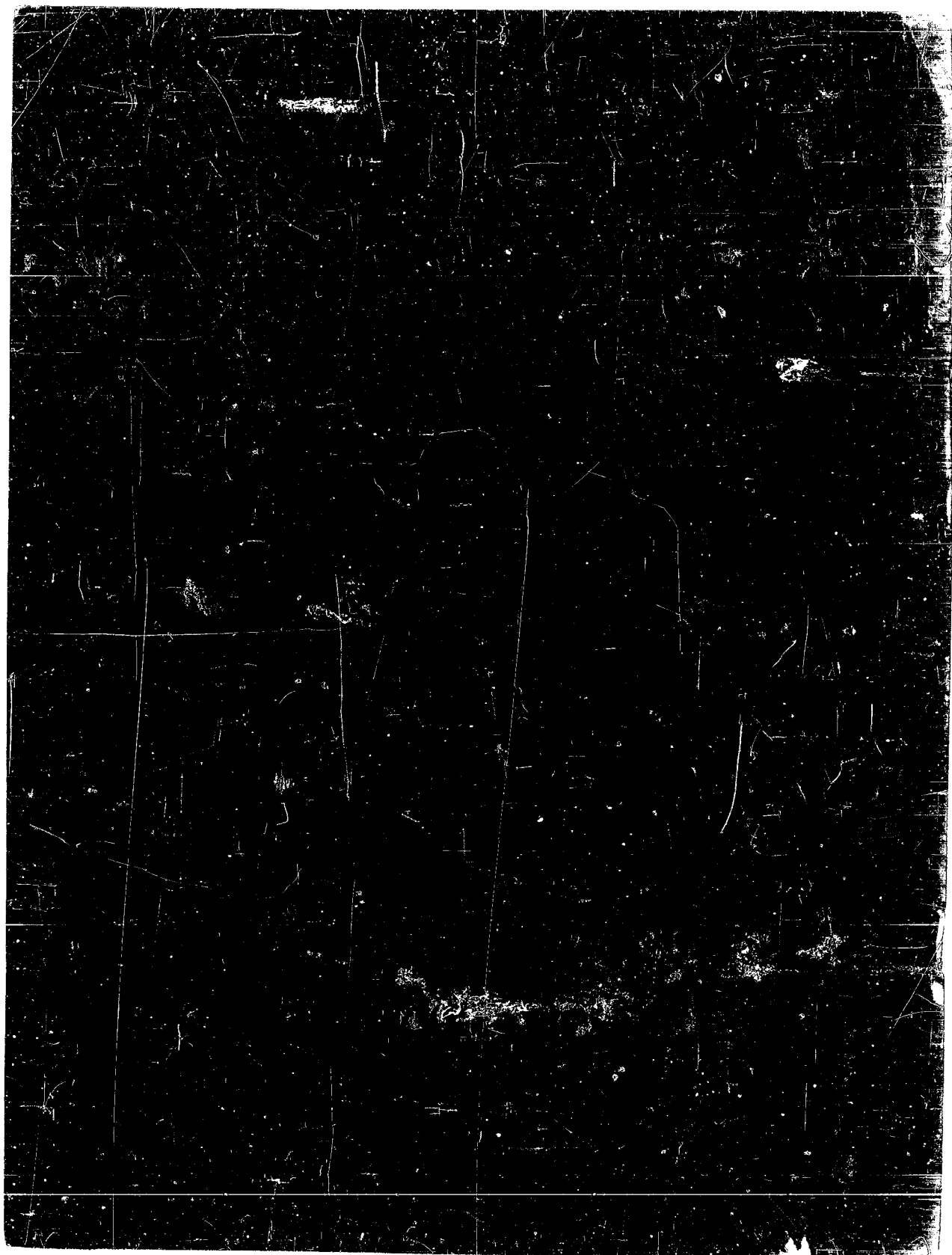


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AD-313 420

HEADQUARTERS  
DEFENSE ATOMIC SUPPORT AGENCY  
WASHINGTON 25, D.C.  
(Formerly Armed Forces Special Weapons Project)

EFFECTS  
OF  
HIGH ALTITUDE NUCLEAR DETONATIONS  
ON  
HIGH FREQUENCY COMMUNICATIONS (U)

Prepared for the  
DEFENSE ATOMIC SUPPORT AGENCY  
by  
William J. Russell, Jr.  
Sol Perlman  
Samuel E. Probst  
U. S. Army Signal Radio Propagation Agency  
Fort Monmouth, New Jersey

August 1959

\* \* \* \*

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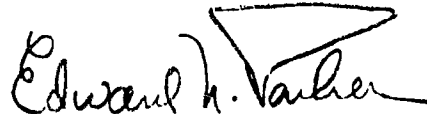
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**LETTER OF PROMULGATION**

"Effects of High Altitude Nuclear Detonations on High Frequency Communications" is a report on the communications outages observed in connection with the high altitude shots TEAK and ORANGE of Operation HARDTACK. The report was prepared for the Defense Atomic Support Agency by the U. S. Army Signal Radio Propagation Agency and is published for the information and guidance of all concerned.

A handwritten signature in dark ink, appearing to read "Edward N. Parker". The signature is stylized with a large, sweeping "E" and a prominent "P".

EDWARD N. PARKER  
Rear Admiral, USN  
Chief, DASA

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## ABSTRACT

The purpose of this analysis is to determine the magnitude of the propagation effects of the high altitude nuclear blasts identified by the code names "Teak" and "Orange" in disrupting the radio communication links of both military and commercial services. The magnitude of these radio communication disruptions is examined for the distances from the blast location, the length of time of the disruption, and the delay in time between the blast and the beginning of the disruption on several communication circuits operating between each of various pairs of geographical terminals. The basis for evaluating these disruptions is primarily the log records of the reporting stations.

Normally, the engineered factors of a communications circuit are designed to enable a minimum acceptable signal to be received under the worst expected conditions. The minimum acceptable signal is the result of not only the attenuation for the length of the path, but also the absorptions and energy scattering along the path and the threshold condition of the receiver. Reliability of communication requires that the minimum acceptable signal be received for a sufficiently high percentage of the time. Propagation outage occurs when identifiably less than a minimum acceptable signal strength, or an unacceptably distorted signal is received for any appreciable time to disrupt standards of message transmission. The effects of Teak and Orange intensified the conditions contributing to propagation outage. The contributing conditions were the upsetting of the stability of the ionosphere, the increased absorption loss of the radiated signal and the loss of support for the higher frequencies in the vicinity of the shot area. The effects spread outward for a few thousand miles from the shot area.

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**SELECTED GLOBAL COMMUNICATION PATHS**

**USED FOR THE ANALYSIS OF**

**TEAK AND ORANGE**

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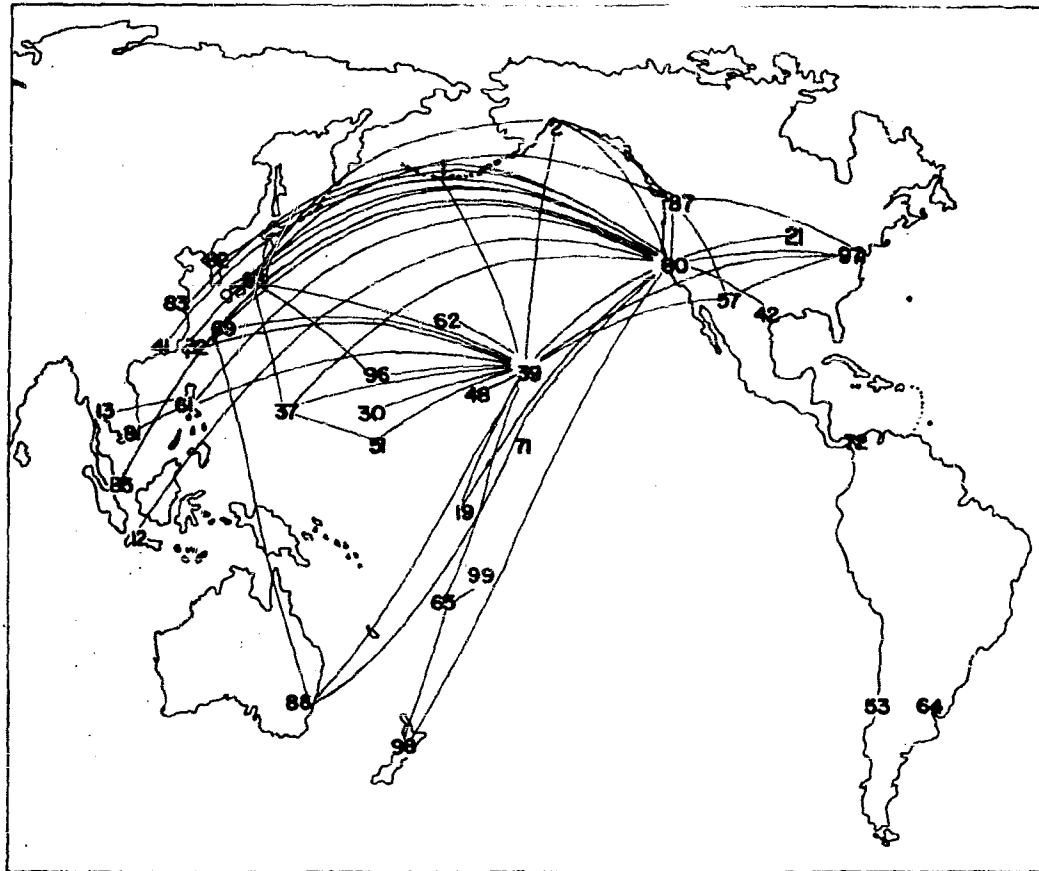
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# SELECTED GLOBAL COMMUNICATION PATHS

USED FOR THE ANALYSIS OF

TEAK TEST

AUGUST 1958



## KEY TO TERMINAL LOCATIONS

1. ADAM	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAN	61. MANILA	72. QUARRY HEIGHTS
6. ASHURA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. HANOI	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. HANOI	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. REIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

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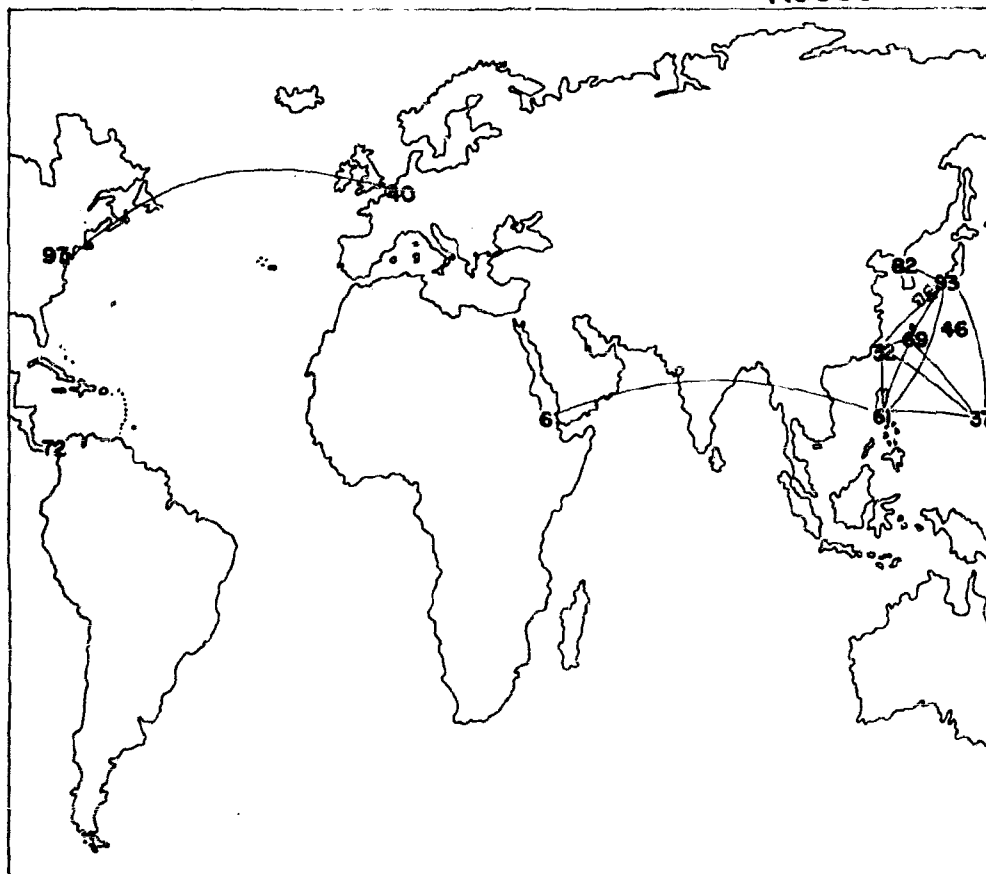
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SELECTED GLOBAL COMMUNICATION PATHS

USED FOR THE ANALYSIS OF

TEAK TEST

AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 61. SINGAPORE | 96. WAKE IS.         |
| 67. SEATTLE   | 97. WASHINGTON, D.C. |
| 68. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

SECRET

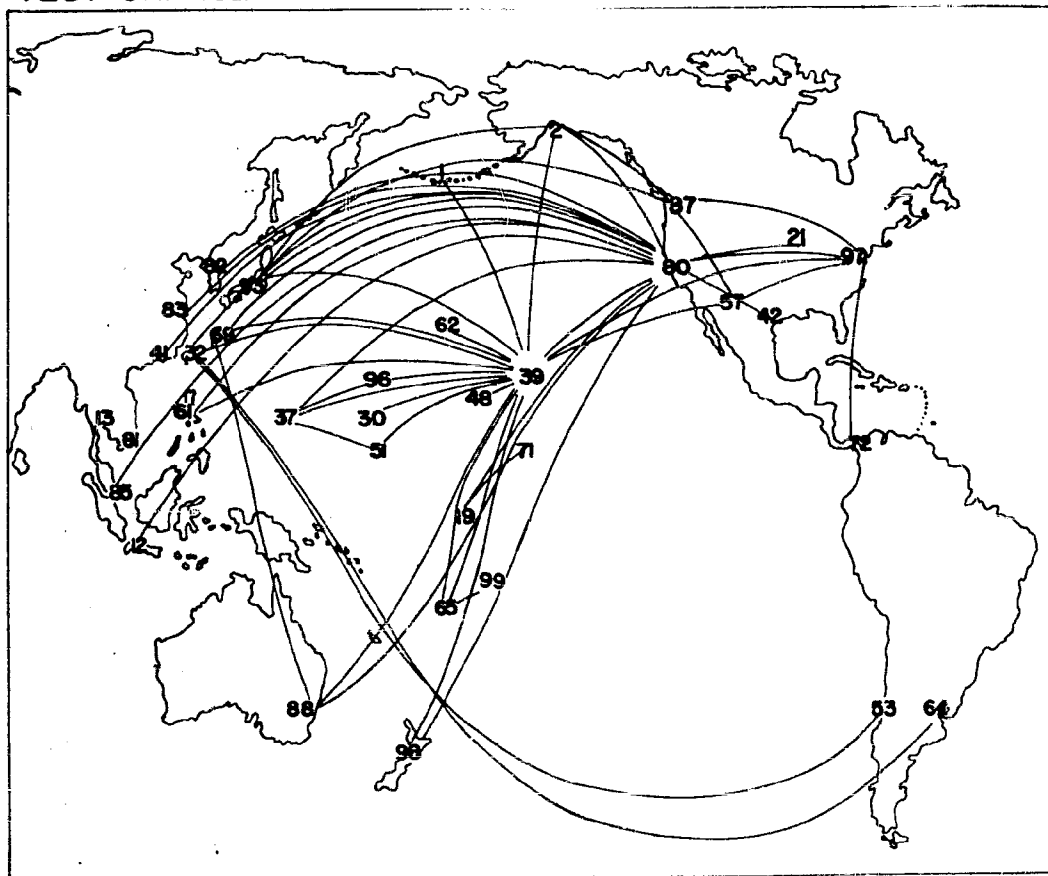
SECRET

# SELECTED GLOBAL COMMUNICATION PATHS

USED FOR THE ANALYSIS OF

TEST ORANGE

AUGUST 1958



## KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

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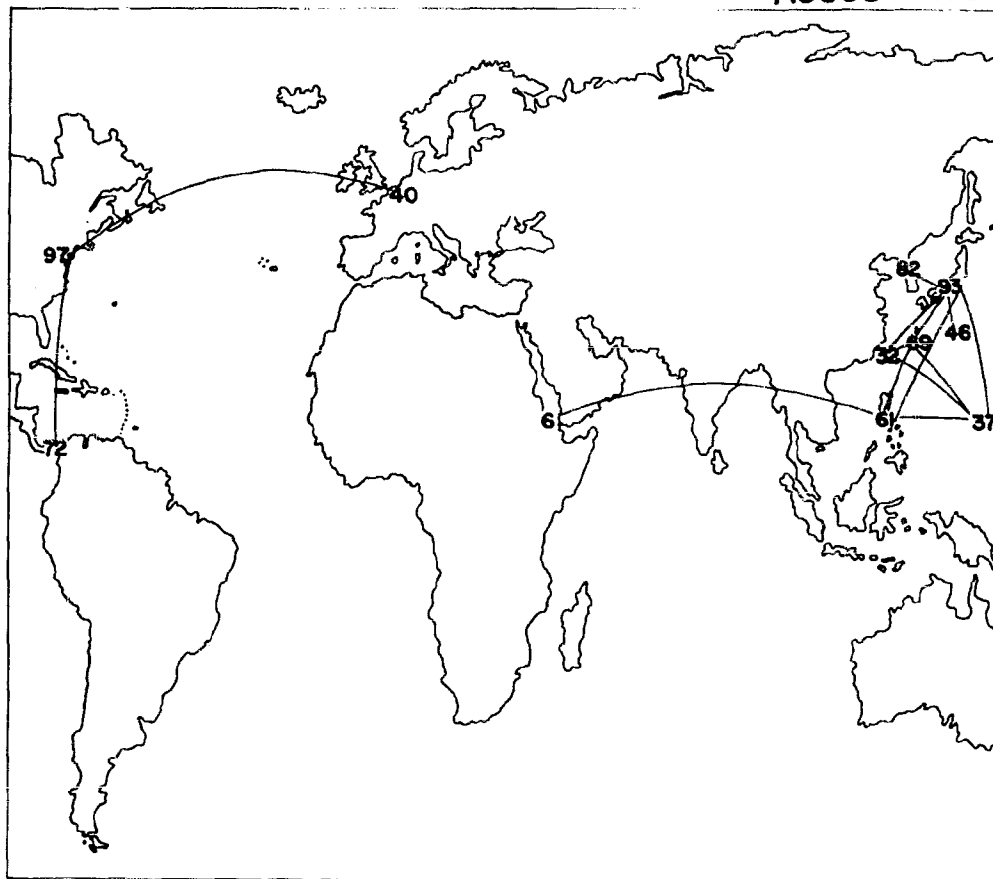
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## SELECTED GLOBAL COMMUNICATION PATHS

USED FOR THE ANALYSIS OF

TEST ORANGE

AUGUST 1958



### KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

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### I. INTRODUCTION

1. A by-product of the release of energy following a nuclear blast is a dense cloud of ionized gases. These hot ionized gases rapidly rise with the fireball and are gradually diffused into the atmosphere. In past nuclear blasts close to the ground, evidences of radiations of radio noise energy were found mainly at the low frequency end of the radio spectrum. The high altitude nuclear blasts identified as "Teak" and "Orange" took place at heights of roughly 50 and 25 miles, respectively. At these elevated heights, the dense cloud of ionization associated with the rising fireball did not fully dissipate itself before attaining the lower reaches of the natural ionization layers. The still turbulent cloud of ionization disturbed and mixed with the natural ionization layers. X, gamma, and beta radiations were released in quantity and reacted on more distant portions of the ionosphere. These effects combined to disrupt communications over a wide region in the vicinity of the blast. It will be shown that the "Teak" shot caused an intense, wide-ranging disturbance to the HF communication band that was limited to a relatively short period of time of about four hours. It will also be shown that the "Orange" shot did not cause either as intense or as wide-ranging a disturbance to the HF communication band but that the effects lasted in some cases into the next day. In general, communication circuits were affected up to distances of a few thousand miles away from the shot location.

2. Since the initial reports indicated that the effects of the nuclear blasts were so widespread, it was decided to analyze the log records of the communication links for the range of distances and duration of the disturbance. Since the technical controllers on duty at the communication sites are primarily responsible for keeping message traffic moving, as a group they do not react to disturbances like trained scientific observers to gather and record their findings objectively and with precision. Rather they make various attempts to regain communication by switching frequencies, transmitters and antennas. Since circuit disturbances similar to those induced by the blast occur naturally from time to time, the technical controllers reacted to these artificial disturbances in their usual way. Although Army, Air Force, Navy and Central Intelligence Agency stations had been informed shortly before "Teak" to be on the lookout for unusual propagation effects, no one was prepared for the magnitude and the duration of the effects. In most cases special monitoring was conducted for only about one hour after shot time. For the Orange blast, the period of special monitoring was extended in many cases to approximately two hours after shot time. No one was prepared for the delayed reaction at dawn some six hours after the "Orange" blast when heavy absorption effects impaired communications. Consequently, not all log records convey the same information on the extent of the effects of both of these nuclear blasts. Also the scientific value of the log records is impaired by the prior demands on the responsibilities of the technical controllers.

3. On the other hand, a curious effect emerges from the log records. Not all circuits in the affected area report simultaneous loss of communication during the time following the high altitude nuclear blasts. Some circuits reported that they continued to operate where others reported loss of communication. A comparison will be made between facilities that were able and those that were not able to communicate over the identical circuit

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paths during certain critical periods. This comparison will be based on available data concerning engineering factors and environments in order to demonstrate which modulations and engineering factors contributed the most to reliability of communications under the disturbed conditions.

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### II. CIRCUIT EXPERIENCE VERSUS FREQUENCY LIMITATION CHARTS

1. This section contains a discussion of the effects on circuits into, out of, or passing near circuit centers in the Pacific Area for which vertical incidence data is plotted.

2. A circuit center is identified as a common terminal for several point-to-point circuits and is understood to include the radio communication receiving and transmitting stations up to approximately 100 miles around a large city. The distance between circuit centers is much greater than the distance of a radio station from the city with which it is identified.

3. An inspection of the charts, Figures 1-40, of consolidated circuit experience of circuit centers such as Honolulu, Midway, Adak, San Francisco, and Okinawa for the days before, of, and after the Teak and Orange nuclear blasts show that a pattern begins to emerge when the sampling is sufficiently large. Of the many locations that could have been chosen, only these have been plotted in this manner because data from a vertical incidence ionosphere station located nearby was available. The vertical incidence data is converted into equivalent 4000-km F-layer and 2000-km sporadic E-layer Maximum Usable Frequencies (MUF) for comparison with the circuit experience at each selected circuit center.

4. It should be pointed out that the circuit experience indicated by solid lines on the charts as outage time is not necessarily due to propagation only. Rather, this is the outage time charged in the log records to propagation failure because the transmission quality was less than acceptable and could not be certainly charged to equipment failure.

5. Although there was much communication activity associated with these tests nearer to Johnston Island (the location of the nuclear blasts), Honolulu is the nearest of the fixed point communication centers to the shot area. A rapid visual comparison will show that, of all of the more important circuit centers, Honolulu shows the maximum effect of both the Teak and Orange shots with the more distant circuit centers from Johnston Island being progressively less affected. This comparison shows that the intensity of the effects diminishes with increasing distance. This observation is particularly pertinent when it is recognized that Honolulu is 810 miles from Johnston Island. Other places reporting the effects of Teak and Orange are at the following approximate distances from Johnston Island:

Midway	935 miles
Canton	1350
Wake	1650
Samoa	2100
Adak	2500
Fiji	2550
Guam	3000
San Francisco	3100
Tokyo	3300
Okinawa	3950
Taipei	4400
Manila	4500

"See map, Figure (41) and Appendices II and III."

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6. From the list of places reporting the effects of Teak and Orange, Honolulu, San Francisco, Tokyo, Okinawa, Taipei, and Manila are major fixed point circuit centers in terms of communication activity. With Honolulu being 810 miles from Johnston Island, the effects there are most intense. The other places being at greater distances from Johnston Island are subject to lower intensity effects since they represent communication paths further from the location of the nuclear blasts. Of the two nuclear blasts, the immediate effects of Teak were the more intense.

7. To the extent that log records were available, data was recorded of circuit experience versus frequency utilization for the day before, the day of, and the day after the nuclear shot in Z (Greenwich Mean) time. The chart for the day before the shot shows the normal behavior of the circuits terminating at the circuit center. The chart for the day of the shot shows the simultaneity and duration of the effects after the shot in impairing the circuits terminating at the circuit center. The chart for the day after the shot shows any lingering effects of the shot before the circuits return to normal at the circuit center. In the following discussions of the effects of both the Teak and the Orange shots respectively, each group of three charts should be studied with these considerations in mind. Except when otherwise indicated, all references will be made in Z time.

8. Immediately after the Teak blast on 1 August, communication both into and out of Honolulu (Figures 1-6) shows a consistent propagation outage pattern that was a maximum in the first four hours but extended over a total of twelve hours. The plots of the effects of Teak on communications into or out of Honolulu do not include data for circuits passing close by, for which Honolulu is not a terminal. At no time within this period, were all circuits inoperative either into or out of Honolulu. A further look at the charts for the 1st of August shows that the operative circuits were distributed over the available HF band from about 5 to 24 mc. The inoperative circuits were spread over the HF band from about 5 to 24 mc. Many logs indicated frequency shifts upward or downward to regain communication, and reported some success in re-establishing circuits. However, frequency shifts upward during the time of day when permitted by a rise in the MUF is normal procedure.

9. The sampling of the circuit experience into and out of Honolulu on the 12th of August (Figures 7-12) shows a modification in the propagation outage pattern compared with that occurring after the Teak blast. After the Orange blast very few of the circuits show an immediate and continuing outage. The major effect of the Orange blast appeared with the approach of local sunrise and continued for the remaining six hours of the chart. The mechanism that apparently accounts for this delayed reaction is absorption due to the photo-dissociation of the blast-generated negative ions by sunlight to create an excess of free electrons in the ionosphere. Actually propagation outage was reported for as much as 24 hours after sunrise at Honolulu following the Orange blast. Again, it is observed that both the operative and inoperative circuits are spread over the HF spectrum from about 5 to 24 mc. After local sunrise, when maximum absorption effects begin, the lower limit of usable frequencies shifts upward to about 13 mc. Note that there is much less evidence of mid-morning propagation outages on the date prior to test Orange.

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10. The apparent greater density of circuits working out of rather than into Honolulu for Teak and Orange is partially due to the monitoring of Navy fleet broadcasts on a number of frequencies simultaneously at several distant points of reception by CIA monitoring stations. There are no corresponding return circuits carrying messages back to Honolulu.

11. The heavy solid curve is the 4000-km equivalent F-layer MUF and the upper heavy dashed curve is the 2000-km equivalent sporadic E-layer MUF based on the vertical incidence ionospheric data taken at Maui for the day recorded on the charts. These MUF's are indicative rather than correct because they were not taken at the individual control points of the circuits. There are so many circuits spread over the azimuth that a MUF at the control point for one circuit would not apply to the control points of other circuits. Furthermore, they differ from the predicted monthly average F-layer MUF that was calculated at the U. S. Army Signal Radio Propagation Agency for the various circuits into or out of Honolulu.

12. For the day of the Teak blast, a break in the heavy solid curve F-layer MUF at 28 mc occurs at shot time. The records of the vertical incidence data taken at Maui for three hours after shot time cannot be used for MUF calculations because these records are too badly disturbed. At about 1400Z, the F-layer MUF curve reappears at about 7 mc. The effect is as if the nuclear blast had blown a hole in the ionosphere in the vicinity of the shot area. As the ionosphere reforms, only the lowest frequencies begin to be supported. The typical spread between a nighttime F-layer MUF and a predawn dip is not as great as the dip in this case when the F-layer MUF reappears. Between about 1500 and about 1730Z, the F-layer MUF has risen from about 6 mc to about 21.5 mc. The rise covers the period of about 0500 to about 0730 Hawaiian Standard Time. This F-layer MUF rise is also much greater than usually occurs during the recovery from the predawn dip. Again attention should be drawn to the apparent circuit operations at frequencies above the equivalent F-layer MUF as based on vertical incidence data taken at Maui. As previously pointed out, the F-layer MUF that applies to a particular circuit is that associated with the control point of that circuit.

13. The 4000-km F-layer MUF based on the vertical incidence data taken at Maui for the day of the Orange shot differs from that of the Teak shot. Here the F-layer MUF begins to drop from about 30 mc at shot time to about 13 mc about four hours later. At this time the vertical incidence records become so disturbed that they cannot be used for determining local F-layer MUF until nine hours after shot time. The lower heavy dashed curve represents the minimum frequency ( $f_{min}$ ) at which a reflection from any ionospheric layer appears on the ionogram. This parameter is normally read as an indication of the ionospheric absorption in the area. On Figures 9 and 10,  $f_{min}$  begins to climb very rapidly at about 1500Z. This rise occurs when the vertical incidence F-layer MUF recordings became unusable at about four hours after shot time. The rising vertical plot of  $f_{min}$  shows an excessive increase in absorption causing the break in the F-layer MUF plot. Although this extremely high  $f_{min}$  lasted only about one and one-half hours, the vertical incidence ionospheric data was too disturbed to be employed for calculating the F-layer MUF for five hours beginning at 1500Z on 12 August. This rising absorption was of relatively brief duration during the Teak shot and is not recorded on Figures 3 and 4. Local effects described previously

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as the result of photodissociation of the negative ions by local sunrise account for the excessive absorption associated with the delayed propagation failures of circuits following the Orange blast.

14. Midway is 935 miles from Johnston Island and 1300 miles from Honolulu. The charts of circuit experience for Midway for the 1st, 11th, 12th, and 13th of August (Figures 13-16) contained more data on circuits that passed near to Midway than into Midway. Midway does have a circuit into Honolulu. Midway is close to the control point for circuits from Honolulu to Tokyo, Okinawa, Taipei and Manila. The effect of simultaneous circuit outage following the Teak shot over a range of frequencies from 5 to about 20 mc is very definitely indicated on Figure 13. At no time, however, were all such circuits disrupted. The effects of Teak are noted at Midway for as much as 10 hours.

15. Figure 14 shows that on the day before the Orange shot some circuits experienced some propagation outage during the predawn and early morning hours. For the day of the Orange shot, some of the many circuits into and near Midway experienced propagation outage prior to shot time as shown by Figure 15. Some of this propagation outage persisted into the hours when the Orange shot caused propagation outage on some of the other circuits near Midway. The general effect was one of prolonged but sporadic outage caused both by natural influences and by the superimposed effects of the Orange shot. Yet over the period of some twelve hours following the Orange shot, there were circuits that continued to communicate in the HF band at one time or another from 5 to 22 mc.

16. The vertical incidence data for Midway is incomplete for the day of the Teak shot. Only between the hours of 0500 and 1000 and between 1800 and 2000 Z was data available to determine the 4000-km F-layer MUF. The f-min data shows no extended period of absorption following the Teak shot that could be plotted on the chart.

17. Figure 15 shows that 4000-km F-layer MUF began to diminish a half hour after Orange shot time. No bottoming of the F-layer MUF appears here as it did at Honolulu. The disturbance noted in the records of the vertical incidence data for about 5 hours after shot time causes a break in the plotted value of F-layer MUF until then. The F-layer MUF then is plotted for another hour. Then a second period of disturbance occurs for an hour so that at about 7 hours after shot time, the F-layer MUF can be plotted without any further breaks. There is some propagation outage that begins with the period of the second break in the F-layer MUF. The f-min data shows no extended period of absorption following the Orange shot that can be plotted on Figure 15.

18. Adak lies some 2500 miles almost due north from Johnston Island. Adak log records show communication with Honolulu primarily. Most of the San Francisco and Seattle circuits which pass near to Adak on the great circle path are plotted on the charts for Adak. Figures 17, 19, 20 and 22 represent normal samples of propagation outage and circuit activity for days prior to and after shot time. Figure 17 shows a little propagation outage 24 hours before the Teak shot but with most circuits working right through. On the day of the Teak shot (Figure 18), the response in propagation outage is delayed in some instances by as much as one-half to one hour following shot time. The propagation outage varied in length from one-half hour in most cases to almost four hours in the worst case in the vicinity of Adak. Many other circuits continued to operate with no outage or with only short outages in

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communication. The 4000-km F-layer MUF shows a drop about an hour preceding shot time. The drop continues to 11 mc about an hour after shot time when the F-layer becomes so disturbed that the records cannot be scaled. On the preceding day, 24 hours before the break, the F-layer MUF was 16 mc. The break in the F-layer MUF for the day of the Teak shot coincides with the time of the beginning of most propagation outages. The end of the break in the F-layer MUF occurs about four hours after shot time at about the time when many circuit propagation outages end. The propagation outages are similar to those at Honolulu but effect a smaller percentage of circuits in operation and for a shorter period of time.

19. Because of the occurrence of propagation outages at about the same time of the day, for the day before, the day of, and the day after the Orange shot (Figures 20, 21, 22), the certainty of associating propagation outages with Orange is seriously impaired at Adak.

20. Charts are available for circuit experience both into and out of San Francisco for the 31st of July, 1st, 2nd, 11th, 12th, and 13th of August (Figure 23-34) Z time. San Francisco, 3100 miles from Johnston Island, is a major circuit center and shows the effect of increased distance from the shot location when compared with Honolulu. For the Teak shot, there is shown a marked increase in propagation outage but affecting fewer circuits and for shorter periods than at Honolulu. This increased propagation outage builds up within the first hour after shot time and does not continue much more than four hours after shot time. For the Orange shot, the indicated propagation outage both into and out of San Francisco differs from Teak in that it was small and no clear association with the shot effects could be established. It should be noted that San Francisco communicates both to the north and east as well as to the west and south with various other places that are not near Johnston Island. This situation diffuses the effect of the nuclear blast on the circuit activity terminating at San Francisco from points in the Pacific.

21. The heavy solid curve showing the 4000-km F-layer MUF for San Francisco shows no unusual behavior as based on vertical incidence data for this location for 31 July, 1, 2, 11, 12, and 13 August. The comments made previously on the relation between such locally determined F-layer MUF and circuit behavior at Honolulu apply as well to San Francisco. This F-layer MUF is not located at a control point for any of the circuit paths into or out of San Francisco. Being determined from vertical incidence data close to San Francisco it can only show local conditions of the ionosphere.

22. The next group of charts of circuit experience to be examined is for Okinawa, 3950 miles from Johnston Island. These charts (Figures 35-40) are for 31 July, 1, 2, 11, 12, and 13 August. Okinawa communicates with Honolulu, Manila, and Tokyo and lies close to the control point for the Tokyo - Manila circuit. The variation in density of the data on these and other charts, particularly for the days before and after shot time, are largely due to availability or lack of availability of log data from all circuits that reported. The charts for 31 July and 11 August being for days before each of the nuclear blasts showed typical samples of propagation outage among the communicating circuits. For the Teak shot, the Okinawa chart shows an increase in propagation outage affecting a

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greater percentage of circuits and of greater duration than at either Adak or San Francisco. These reported outages are distributed over a period of twelve hours. Some circuits recover about four hours after shot time and go out again nine hours after shot time. Not all propagation outage patterns are alike or simultaneous, but there are two periods of maximum occurrence of outage evident on the chart. This observation is reinforced by the behavior of the available ionosphere data which shows 2 periods during which it could not be scaled for F-layer MUF. For the Orange shot, there are several propagational outages of 8 to 20 hours duration. Three of these major outages started before shot time and therefore appear to be associated with more local causes of ionospheric disturbance. These local causes of ionospheric disturbance combined with the Orange shot effects account for the amount of propagation outage shown on the chart. However, it should again be noted that other circuits were operative over the band of 5 to 23 mc.

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### III. SEQUENCE OF SYNOPTIC MAPS

1. In order to obtain an overall geographic concept of the effects of Teak and Orange on the performance of the communication circuits, a sequence of synoptic maps (Figures 41-122) of the reported circuit experience was generated. Each map is a modified cylindrical projection of the globe. On these maps, each of the terminal locations of the reporting circuit paths is identified by a number as listed in the "Key to Terminal Locations." Each of the reporting circuits is shown by a line approximating a great circle connecting a pair of terminal locations.

2. Each map summarizes circuit data for a time interval of an hour centered on either the hour or half hour of Z time. A pair of great circle lines mark the division between day and night at the beginning and the end of the hourly interval. The great circle line to the right marks the beginning of the hourly interval and the one to the left marks the end of the hourly interval. Circuit paths that are partially in daylight and partially in darkness pass through this moving boundary line.

3. Each circuit path is shown as either a solid, a long-dashed, or a short-dashed line. The solid line is for a circuit path showing a successful communication performance of 80% or greater of the total frequency-quarter-hours of circuit experience reported by all services using the path. A long-dashed line is for a communication experience between 30% to 80% successful. Finally, a short-dashed line is for communication experience of 30% or less that is successful. The fraction associated with each circuit path is the communications capability. The numerator of the fraction represents the number of frequency-quarter-hours of successful communications, and the denominator is the number of frequency-quarter-hours for which circuit experience was reported. Circuit operation for intervals of less than fifteen minutes are included in the totals. Where the denominator is small, a change of one unit in the numerator causes a larger percentage change than where the denominator is large. It is to be noted that where the denominator is large, many more circuits are reported as using this circuit path. Available reports received from the Army, Navy, Air Force, CAA, AT&T, Globe Wireless, Mackay Radio, or any other agency that supplied records of operation during the period of the Teak and Orange tests were used. The type of modulation used, the power of the transmitter, the gain of the transmitting and receiving antennas, and the frequency employed at any hour of the day are disregarded in these summations.

4. Those maps with the time interval centered on the half hour were included to show in greater detail the effects of Teak and Orange for several hours after shot time. Lesser changes are shown only by changes in the fraction associated with the path and greater changes by changes in the line symbol identification.

5. As either the behavior of a circuit path, a group of circuit paths, or the overall array of circuit paths on the sequence of synoptic maps is studied, a pattern unfolds. Circuit paths that differ slightly in azimuth angle and originate from a common terminal differ in length of circuit path to a greater or lesser degree. For example, the circuits common to San Francisco and connecting with Tokyo, Okinawa, Formosa, and Hongkong are respectively about 5150, 6100, 6450, and 6900 miles but differ

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by less than 6 degrees in azimuth. Tokyo is about 75% of the distance to Hongkong. The control points at the far end of these circuits from San Francisco are spread over about 1800 miles. If the propagation conditions at the far end control point of these paths of varying length are also varied in support frequency, the capability for successful communication will be affected accordingly.

6. For example, at a time interval centered on 0000Z, 1 August 1958, (Figure 41) in communicating with San Francisco, Hongkong showed a ratio of 0/4, Formosa showed a ratio of 6/6, Okinawa showed a ratio of 8/8, and Tokyo showed a ratio of 24/40. Since Formosa and Hongkong show a path length difference of only 450 miles and are both in daylight, it is probable that factors other than differences in propagation conditions account for the difference in communication performance. The differences in communications performance can more probably be ascribed to variations between these circuits in transmitter power, receiver sensitivity, receiving and transmitting antenna gains, types of modulation in use, number of channels in use, suitability of assigned frequencies, and correctness of log records. Thus under normal conditions of communication, independent of the effects of Teak and Orange, engineering and operational factors affect the records of reported circuit experience. In the same hourly interval, a similar comparison could be made of Honolulu communicating with Okinawa and Formosa. This indication of various degrees of difficulty under normal propagation conditions tends to reduce the significance of propagation outages as indications of the effects of Teak and Orange. Some data records, such as those from Adak which include monitoring of WWVH, contain prolonged normal propagation outages which do not represent communication losses. Furthermore, the communications performance of each circuit path is as dependent on engineering and operational factors as it is dependent on propagation factors. It should be noted that these maps show only data that was made available as log or other station records. Incompleteness in these station records affect these computed results. For example, circuit log records from such places as Canton Island, Nandi on Fiji Islands, and certain CAA records were prone to report periods of outage while not clearly stating when the circuits were operating normally. These deletions affect the accuracy of the data analysis.

7. Both Honolulu and San Francisco are common terminal points for numerous circuit paths in the Pacific and continental United States areas for which log data is available. Honolulu being some 820 miles from Johnston Island is of major interest as representative of circuits that are close to the shot location. Circuit paths from Honolulu lie mainly in the Northeast, Northwest, and Southwest quadrants. No log records are available for circuit paths in the Southeast quadrant from Honolulu. Circuit paths from San Francisco also occupy the Northeast, Northwest, and Southwest quadrants from this communications center. Many circuit paths from San Francisco go across the Pacific on great circle routes that lie to the north of Honolulu by more than 1000 miles. These North Pacific routes out of San Francisco should show the more remote effects of the Teak and Orange shots. The routes from Honolulu and San Francisco will be discussed primarily, but the maps will show other routes in the Pacific as well as Atlantic regions that are of lesser significance.

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8. Depending on the length of the circuit path, on the more powerful signal that could be transmitted by better engineered circuits, and on the more reliable type of service rendered by particular forms of modulation, some of the reported circuits were better able than others to maintain communications. An examination of the consolidated data and the subsequent discussion will show that some of the available circuits in most hourly periods succeeded in maintaining communications during the worst effects of Teak and Orange.

9. To simplify the discussion of the sequence of the synoptic maps with respect to circuit paths that terminated in Honolulu and San Francisco for Teak and Orange, four tables (beginning on Page 170) were made of the ratios of satisfactory frequency-quarter-hours to transmitter operation frequency-quarter-hours. The ratios are tabulated for the successive hourly intervals centered on either the hour or half-hour for each circuit path examined. Trends in circuit path activity that correlate with the effects of Teak and Orange are then more easily studied.

10. Honolulu circuit paths for Teak. (Figures 41 to 72)

(Table I) Since the Teak shot occurred in the vicinity of Johnston Island, the major effect was felt there and diminished with increasing distance. The Teak shot took place at 1050Z, which was 50 minutes past midnight, Hawaiian Standard Time.

a. The circuits communicating between Honolulu and Los Alamos are military. Up to 1200Z, no effect on communication reliability occurred with a ratio of 8/8 maintained. For the hour centered at 1230Z, the ratio decreased to 4/8. Over the four hour period from the hour centered at 1300 to 1600Z no communication was possible. From 1630 to 1730Z, the circuit gradually recovered until it was fully restored from 1730Z to the end of the day of 1 August Z-time. Teak did not affect this circuit until 1230Z, about one hour and forty minutes after shot time.

b. The circuits communicating between Honolulu and Washington, D. C. are military. Up to 1130Z, communication reliability was maintained with a ratio of 8/8. In the hourly interval centered at 1130Z, this circuit dropped to a ratio of 6/8. In the hourly interval centered at 1200Z, the ratio dropped to 4/8. The lowest ratio of 3/8 occurred in the hourly interval centered at 1230Z. The ratio went up again in the hourly intervals of 1300 to 1530Z to 4/8. From the hourly interval centered at 1600Z to Greenwich midnight, the ratio rose and stayed at 8/8. Over a period of four hours and thirty minutes, this circuit path was operating at reduced capacity, although at no time was it completely inoperative. Some of the circuits survived the worst effects of Teak by operating just above the marginal limit of communication.

c. The circuits communicating between Honolulu and San Francisco are both military and commercial. Up to 1130Z as indicated by the hourly period of 1100Z communication reliability was maintained with a slightly fluctuating but high ratio reflecting little or no outage much of the time. In the hourly interval centered at 1130Z, this circuit showed a small decrease in ratio to 42/46. The maximum effect of Teak began in the hourly interval centered at 1200Z with a ratio of 32/47. This maximum

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effect of Teak occurred about an hour after the shot. The maximum effect continued in the hourly interval centered at 1230Z with a ratio of 36/55. The circuits gradually improved until at the hourly interval centered at 1900Z it is fully recovered with a ratio of 69/69. Since the maximum effect of Teak caused a ratio of 32/47 in the hourly interval centered at 1200Z, 68% of the available transmitter operation in frequency-quarter-hours was available for satisfactory communication under the worst condition.

d. The Anchorage to Honolulu circuit path showed an effect from Teak at the hourly interval centered at 1130Z with a ratio of 4/10. The maximum effect of Teak occurred during the hourly intervals centered on 1300 and 1330Z with a ratio of 0/16. From the hourly interval centered at 1430Z to that at 1530Z, the ratio was 12/16. The circuit was fully recovered in the hourly interval centered at 1800Z. Reduced ratios of 11/16, 13/16, 13/16, and 12/16, occurred in the hourly intervals centered at 1630, 1700, 2200 and 2400Z respectively. This is primarily a military circuit path. The engineered installations do not appear to have had sufficient margin in communication capability to withstand the effects of Teak during at least the first four hours after the shot.

e. The Adak to Honolulu circuit path data for Teak consists only of continuous monitoring of WWVH broadcasts at 10 and 15 mc. The outages shown during the night preceeding and following the shot may be at least partially attributed to normal expected MUF failure. It is difficult to say that the ratio of 6/8 in the hourly interval centered at 1130Z or the reduced ratios appearing during the balance of the day were an indication of the effect of Teak.

f. The first records for the Midway to Honolulu circuit path began at the hourly interval centered at 1030Z, when the ratio is 0/1. Midway to Honolulu path appears to have had propagational difficulties at the start and it appears that the effects of Teak prevented communication from ever getting established that day.

g. The Tokyo to Honolulu circuit path is heavily active with military and commercial communications. Until the hourly interval centered at 1030Z all circuits with very few exceptions operated reliably. In the hourly interval centered at 1100Z the ratio dropped to 55/82. This hourly interval included the first 40 minutes after Teak. The previous hourly interval centered on 1030Z included the first 10 minutes after Teak, but showed no loss of communication capability. This shows that the effects of Teak on this circuit path were delayed by at least ten minutes if not longer. In the hourly interval centered at 1130Z, the first maximum effect of Teak is noted with a ratio of 33/80. For the remainder of the Teak day, the circuit path operated at reduced communication capability. The lowest communication capability occurred at the hourly intervals centered on 1530Z and 1900Z with ratios respectively of 16/57 and 14/68. These dips in communication capability seem to be associated most closely with the predawn dip typical of normal propagational conditions (Dawn occurred at about 1600Z at Honolulu and at about 2000Z at Tokyo). On the other hand, Teak affected the communication capability of the Tokyo - Honolulu circuit path more than it did the San Francisco - Honolulu circuit path. The added mechanism of absorption due to photodissociation of negatively charged ions with the appearance of sunrise on the path may have contributed to the difficulties experienced on the Tokyo -

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### Honolulu circuit path.

h. The Okinawa to Honolulu circuit path is primarily for military communication. Although this circuit was active and adequately reported from the start of the radio day, it suffered virtually no outage until shot time. The communication capability then deteriorated for an hour and one half to a minimum value of 4/16 which persisted for about eight hours, followed by complete recovery. As in the case of the Tokyo circuits, the circuits on this path suffered prolonged and severe disturbances following Test Teak.

i. The Formosa to Honolulu circuit path is primarily for military communication. During the first 4 hours of the radio day, the reported circuit experience built up rapidly while the communication capability progressively improved. The first post-shot outage was observed in the hour centered on 1230Z. A minimum in communication capability was first reached in the hourly interval centered on 1330Z, about 2 hours and 40 minutes after shot time. It lasted about 3 hours, and tended to reappear 5 hours later. Although Okinawa and Formosa are on the same azimuth from Honolulu the circuits from Honolulu to Formosa suffered far less from propagation outages than did those from Honolulu to Okinawa. This difference in performance indicates that the Formosa to Honolulu circuits were probably engineered to provide stronger received signals under comparable propagation conditions.

j. The Manila to Honolulu circuit path is utilized for both military and commercial communication. It is a long circuit path of 5290 miles. At shot time there occurred a considerable increase in circuit experience reported as unsuccessful. The first period of minimum ratios extended from the hourly intervals of 1100 to 1400Z. The second period of minimum ratios extended from the hourly intervals of 1600 to 2100Z. Complete loss of communication occurred in the hourly interval centered at 2000Z which is about an hour before local dawn at Manila. The outage at this time can be associated with the predawn dip of normal MUF behavior and the added effect of absorption due to the photodissociation of negative ions by sunlight at ionospheric heights. Circuits to the west of Honolulu seemed to suffer more than circuits to the east of Honolulu.

k. The circuit paths between Honolulu and the Pacific islands of Wake, Guam, Eniwetok, and Kwajalein are used primarily by the military, although some CAA traffic passes on the Wake path. All of these paths were profoundly disturbed after shot time. However, the Wake Island path provided no data until just before shot time (when it was completely out) and it stayed out for 2 hours after the shot. It then made a partial recovery for the rest of the day. The performance of the others deteriorated during the hour after the blast and they remained completely out for about the next 6 hours. Recovery occurred at roughly the time of local daybreak in the area. The superior performance of the Wake circuits could reflect the greater distance of the control point of this path from the center of disturbance.

l. The Johnston Island - Honolulu circuit is used mainly by the military. This path had heavy and successful traffic prior to the shot; only limited experience was reported for the next two hours but it,

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too, was successful. During the remainder of the day attempts were made to resume the heavy flow of traffic, but with limited and irregular success. There were no hours of complete outage, the minimum performance occurring eight hours after the blast. The surprisingly adequate performance of this path may be partly explained by the fact that the major centers of disturbance were directly over the island and at the geomagnetic conjugate, whereas the control point of the path was some four hundred miles away.

m. The Sidney to Honolulu circuit path is mainly commercial communication. The reported log data extends from the hourly intervals centered on 1030 to 2400Z. Commercial standards of quality determined when these circuits were usable.

n. The Canton Island to Honolulu circuit has reported log data that extends from hourly intervals centered on 1030 to 1700Z. No communication occurred during this time in spite of a maximum of eight frequency-quarter-hours of transmitter operation.

o. The Nandi, Fiji Island to Honolulu circuit path has log data for hourly intervals extending from 1000 to 2300Z. During this period, the only successful communications occurred from 1800 to 2100Z and even then represented a small fraction of the total attempted.

### 11. San Francisco Circuit Paths for Teak (Table II)

San Francisco is about 2400 miles from Honolulu and is about 3100 miles from Johnston Island. Many of the circuits from San Francisco connect with places close to or on the Asiatic continent. These circuit paths are removed by about 1500 or more miles from Johnston Island and should be less affected by the Teak shot than the paths out of Honolulu.

a. Fort Sam Houston, Texas to San Francisco is mainly a military circuit path and shows no unusual communication outage associated with the Teak shot. The same is true for the Washington to San Francisco circuit path, for the Chicago to San Francisco circuit path, for the Seattle to San Francisco circuit path, and the Anchorage to San Francisco circuit path.

b. The Korea to San Francisco circuit path showed definite effects from the Teak shot. In the hourly interval following the shot the ratio began to drop and the outage became complete at 1300Z. Two hours later a rapid recovery occurred, followed over the remainder of the day by variable difficulty including another hour of complete outage at 2000Z.

c. The Hongkong to San Francisco and Formosa to San Francisco circuit paths showed what appeared to be a delayed effect from the Teak shot, however, since comparable outages were indicated prior to the shot, the post-shot outages may be due to propagation difficulties normal to this circuit path.

d. The paths between San Francisco and Tokyo, Okinawa, and Manila operated so well most of that day that reduced communication capability commencing at shot time is most probably connected with Teak.

e. The Bandung to San Francisco circuit path is not

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significant in its indications since the data begins after shot time. The apparent effects are delayed by at least an hour after shot time.

f. The Guam to San Francisco circuit path is nearer to the area affected by Teak. The circuit path performed well prior to shot time. The performance was degraded in the hourly intervals immediately following the shot and communications were totally lost by 1230Z.

g. The Sidney to San Francisco circuit path, 7420 miles long, passes very close to the test area which makes it more vulnerable to the effects of the Teak shot. This circuit path performed well prior to shot time at 1050Z. In the succeeding hourly intervals up to that centered on 2000Z, no communication was possible. In the hourly intervals centered on 2000 and 2300Z, the circuit path recovered but failed again in the following hourly intervals.

### 12. Honolulu circuit paths for Orange (Table III) (Figures 73-122)

The Orange shot also occurred in the vicinity of Johnston Island and, in general, the major effect diminished with increasing distance. The Orange shot took place at 1030Z (30 minutes past midnight Hawaiian Standard Time), 12 August 1958 at a height of about 25 miles above the earth's surface. The severity of the first effect of the Orange test was more confined in area and did not affect as much of the communication activity or for as long a time as the Teak test. The second and major effect of the Orange shot was associated with the signal absorption resulting from excess electrons released from negative ions by photodissociation with the appearance of sunrise on the ionized cloud spreading outward from Johnston Island. With Johnston Island being 820 miles to the west of Honolulu, the spreading ionized cloud had more effect on circuits to the west than on circuits to the east of Honolulu when sunrise appeared in this region.

a. The Los Alamos to Honolulu circuit path is mainly for military communication. Up to the hourly interval centered on 1230Z, two hours after shot time, the communication capability was unimpaired. The circuit capability was reduced and fluctuated from the first effect of Orange between the hourly intervals centering on 1300 to 1500Z. The second effect of Orange caused the circuit to drop out completely between the hourly intervals centered on 1530 to 2030Z. The circuit rapidly recovered in the hourly interval centered on 2100Z and stayed recovered until 24 hours after shot time.

b. The Washington D. C. to Honolulu circuit path is mainly for military communication. After operating at almost maximum capability until about 1300Z, the circuit capability was reduced and fluctuated between the hourly intervals centered at 1330 to 1500Z. The second effect was observed when the circuit dropped out completely in the hourly intervals centered on 1530 and 1600Z. The circuit was recovering, but operating at 50% of capability over most of the period up to the hourly interval centered on 2000Z. From then, until 24 hours after shot time where the record ends, circuit operation appeared normal.

c. The San Francisco to Honolulu circuit path is for both military and commercial communication. Up to the hourly interval centered on shot time, the circuit capability was almost maximum. From then to 1600Z,

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the circuit capability was reduced approximately 12% and fluctuating. Between the hourly intervals centered on 1600 to 2300Z, the second effect of Orange caused the circuit capability to fluctuate between 45% to 75% in two distinct intervals. Between the hourly intervals centered on 0300 to 1000Z on 13 August, the decrease to 82% of circuit capability was reached in the hourly intervals centered on 0600 and 0700Z. During the effects of Orange, the communication capability of this circuit path was at no time less than 45%. That the effects of Orange were not more serious is considered to be due to the well engineered circuits in use.

d. The Anchorage to Honolulu circuit path is mainly for military communication. Communication capability was 100% up to about 1100Z. From then to 1600Z, fluctuations in path capability occurred. Minimum performance of the circuit was logged in the hourly intervals centered on 1630 to 1830Z when the second effect of Orange was indicated. Sunlight should appear on this northerly path at about 1600Z. No further impairment of communication was logged until the record ended.

e. The Adak to Honolulu circuit path log records include monitoring of WWVH. The reduced capability recorded for this path may have been as much due to normal propagation outage as to the effects of the Orange shot.

f. The Midway to Honolulu circuit path is 1296 miles long and is mainly for military communication. This circuit worked at maximum capability up to an hour after shot time. The circuit capability decreased to zero over most of the next 12 hours.

g. The Tokyo to Honolulu circuit path is for both military and commercial communication. Prior to shot time propagation outage existed on this path to a greater or lesser degree. No propagation outage could be associated with the first effect of Orange. Between the hourly intervals centered on 1630 to 2400Z, the increase in outage appeared to be due to the second effect of Orange. In the hourly intervals centered on 1930Z and 2000Z, no communication occurred although many transmitters were on the air. For the reported time on the radio day of 13 August, communication was again at a maximum.

h. The Okinawa to Honolulu circuit path is mainly for military communication. The presence of normal propagation outage obscured the effects of Orange. The minimum capability of 8/16 occurred in the hourly interval centered on 1130Z and 1200Z. Other minima occurred at the hourly intervals centered on 2100, 2230, and 2330Z respectively.

i. The Formosa to Honolulu circuit path is mainly for military communication. Because this circuit path was experiencing some propagation outage prior to the Orange shot, propagation outage from shot time to 0700Z of 13 August could be due to both causes as well as to either one alone. Between the hourly periods centered on 1330Z, 12 August to 0300Z, 13 August, no communication was possible.

j. The Manila to Honolulu circuit path is mainly for military communication. The first effects of Orange appeared to affect communication during the hourly intervals centered on 1030 to 1130Z. The second effect occurred between the hourly intervals centered on 1830 to 2400Z. The second

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effect was greater than the first effect in impairing communication.

k. The Wake to Honolulu circuit path is mainly for military communication. The first effect was not observed on this path. The propagation outages that occurred in the hourly intervals centered on 1830 to 2400Z of 12 August are caused by the second effect of Orange.

l. The Guam to Honolulu circuit path is mainly for military communication. The first effects of the Orange shot are noted during the hourly intervals centered on 1100 to 1300Z. The second effect of the Orange shot was noted during the hourly intervals centered on 1630 to 2400Z, with no communication in the hourly intervals centered on 2000 and 2100Z.

m. The Eniwetok to Honolulu circuit path is mainly for military communication. The first effect of Orange was noted during the hourly intervals centered on 1030 to 1130Z. The second effect of Orange was observed between the hourly intervals centered on 1630Z, 12 August to 0100Z, 13 August. No communication occurred in the hourly intervals centered on 1800 to 2100Z and that at 2300Z.

n. The Kwajalein to Honolulu circuit path is mainly for military communication. The first effect of the Orange shot was noted during the hourly intervals centered on 1100 and 1130Z. The second effect of Orange occurred between the hourly intervals centered on 1830Z of 12 August to 0200Z of 13 August. Minimum communication capability occurred during the hourly intervals centered on 2000 to 0100Z.

o. The Johnston Island to Honolulu circuit path is mainly for military communication. Propagation outages prior to shot time mask the first effect of Orange. These same normal propagation outage causes also mask to some extent the second effect of the Orange shot. No communication was possible between the hourly intervals centered on 1830 to 2400Z. At the hourly interval centered on 0700Z of 13 August, all circuits were fully restored.

p. The Sidney to Honolulu circuit path is mainly for commercial communication. From the hourly intervals centered on 1730Z on 12 August to 0300Z on 13 August, no communication was possible although transmitter operation was reported. This outage is charged to the second effect of Orange.

q. The Canton Island to Honolulu circuit path is mainly for commercial communication. Reported transmitter operation occurred for the hourly intervals centered on 1730 to 2400Z. In the hourly intervals centered on 2030 to 2400Z, no communication was possible. This is the period of the second effect of the Orange shot.

r. The Nandi, Fiji Islands to Honolulu circuit path is mainly for commercial communication, and reported transmitter operation from the hourly intervals centered on 1600 to 2400Z. Due to the second effect of Orange, no communication occurred.

### 13. San Francisco Circuit paths for Orange (Table IV)

On the circuit paths having San Francisco as one terminal, the

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effects of Orange are not as readily recognizable. In the circuit paths that are affected, there is a reasonable time correlation of the first and second effects of the Orange shot.

a. The Fort Sam Houston, Texas to San Francisco circuit path is mainly for military communication. The propagation difficulties between the hourly intervals centered on 1030 to 1330Z may be just as likely due to lack of nighttime support for the frequencies used as to the effects of the Orange shot since this circuit path is so far removed from the shot location. The propagation difficulties that occur from the hourly interval centered on 1730Z onward occur well after sunrise appeared on this path. No definite association with the more dominant second effect of Orange can be found in the presence of the propagational difficulties on this path. The same analysis can be applied to the data for the Washington to San Francisco circuit path, to the Chicago to San Francisco circuit path, to the Seattle to San Francisco circuit path, and to the Anchorage to San Francisco circuit path.

b. The Korea to San Francisco circuit path is mainly for military communication. Reduced communication capability when it does occur on this path does not coincide with either the first or second effect of the Orange shot.

c. Such data as is available for the Hongkong to San Francisco circuit path and for the Formosa to San Francisco circuit path does not coincide with either the first or second effect of the Orange shot.

d. The Tokyo to San Francisco circuit path is for both military and commercial communication. During the hourly intervals centered on 1100 to 1330Z, the reduced communication capability on this circuit path coincides with the first effect of the Orange shot. During the hourly intervals centered on 1230 and 1300Z, a 10% reduction in capability occurred. The reduced communication capability during the hourly intervals centered on 1800 to 1930Z coincide the second effects of the Orange shot. In the hourly interval centered on 1830Z, a reduction of 33% in circuit capability occurred.

e. From the available data for the Okinawa to San Francisco circuit path, Bandung to San Francisco circuit path, Sidney to San Francisco circuit path, Singapore to San Francisco circuit path, Shanghai to San Francisco circuit path, Wellington to San Francisco circuit path, and the complete data for the Manila to San Francisco circuit path does not coincide with the first or second effect of the Orange shot.

f. The Guam to San Francisco circuit path is mainly for military communication. The propagation difficulties on this path do not coincide directly with either the first or second effect of the Orange shot. The reported reduced effects of communication capability occurred between the hourly intervals centered on 1330 to 1700Z, and centered on 1800 to 2400Z of 12 August, and centered on 0600 to 1100Z of 13 August. The reduced communication capability occurred some two to two and one half hours after the corresponding times for the first and second effects of the Orange shot as felt at Honolulu.

14. The first and second effects of the Orange shot affected communication capability of circuits that have one terminal in Honolulu much more

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recognizably than that of circuits that have one terminal in San Francisco.  
The Orange shot was more local in its effects than the Teak shot.

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### IV. EFFECT OF ENGINEERING FACTORS ON PROPAGATION OUTAGE

1. As stated previously, propagation outage due to Teak and Orange more often occurred on communication circuits located closer to the shot area. This is particularly observed on circuits having one terminal that is close to the shot area such as Honolulu. Honolulu is a major radio communication center in the Pacific Area and is used by many military and commercial radio links. These radio circuits represent a wide range of engineering factors in their design and construction. Not all circuits operating during the period immediately following Teak and Orange suffered to the same extent from propagation outage. The differences in engineering factors among the circuits must have contributed the deviations in the effects on signal reception.

2. To analyze the relationship of the engineering factors to the reliability of communication under the more difficult propagation conditions caused by the effects of Teak and Orange, the performance of point-to-point circuits having one terminal in Honolulu is discussed in the following paragraphs. This discussion will be based on Figures 123-140 which present the operating experience of the individual circuits on a frequency versus time of day basis. The plots are made for the radio day of Teak and Orange respectively on modified MUF-LUF charts. Each path for each radio day is presented on a sequence of three charts.

3. The first chart of the sequence contains the hours of operation for the radio day of each circuit transmitting in both directions over the specified circuit path. The transmitting circuits include all military, other governmental and commercial services communicating by radio between these terminals for which data was available. Each circuit is identified with the receiving agency, type of service, and the user's designation when more than one circuit was in operation. That period of operation which is satisfactory is identified by a dotted portion of the line, and that period of operation which is associated with propagation outage is identified by a solid line. The arrowhead at one end of the line or the other designates the direction toward which the signal is being transmitted as identified in the title. When no transmission occurs, no portion of the line is drawn for this period of time. Superimposed on the chart are curved lines associated with the MUF and LUF. Across the upper part of the chart is a continuous solid curve connecting plotted points which are the predicted monthly average MUF for the circuit path. Also across the upper part of the chart is a solid curve with a break in it at or within about four hours after shot time. This solid curve is the equivalent 4000-km F-layer MUF determined from vertical incidence data for the radio day of the shot taken at the Maui Ionosphere Station. The dashed curve with discontinuities in it across the upper part of the chart is the 2000-km sporadic E-layer MUF determined from the vertical incidence data for the radio day of the shot taken at Maui. The longer dashed curve across the lower half of the chart is the f-min transcribed from the same vertical incidence data. The curves plotted from the vertical incidence data are not characteristic of the path control points of any circuit. However, this is the only ionospheric data that is available that can be compared with the effects on communication that occurred on circuits terminating at Honolulu on the radio day of each nuclear shot. This

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propagation data is close enough to the control points of the Honolulu terminated circuits to be useful for comparisons.

4. The second chart of the sequence contains the available data on ACAN and AACCS circuits transmitting to Honolulu. For this purpose, the engineering factors of transmitter power, type of service on the circuit, and the transmitting and receiving antennas used on the circuit are specified. The MUF and f-min curves are copied from the first chart of the sequence. The additional curves plotted on this chart are the one or more LUF's that are identified with an ACAN and/or AACCS circuit operating over that circuit path. The LUF is identified with the engineering factors of the circuit using that path specified in the key.

5. The third chart of the sequence contains the available data on ACAN and AACCS circuits transmitting from Honolulu. The information given in the previous paragraph for the description of the data on that chart applies to this chart also. Only ACAN and AACCS circuit information is used on the second and third charts of each sequence for reasons including the following:

a. Inquiries for engineering information on the circuits of non-military and commercial agencies could arouse curiosity by persons not under control of military security.

b. Engineering factors supplied by non-military and commercial circuits were not directly applicable to the techniques utilized by the Radio Propagation Agency for calculation of LUF's.

c. ACAN and AACCS engineering factors were available to the U. S. Army Signal Radio Propagation Agency through existing channels. The correctness of the data for the day of the nuclear shot could be verified.

d. This analysis of the effects of nuclear detonations on the reliability of communication, is of primary interest to the military.

6. The LUF's are based on monthly predicted propagation conditions for normal communication on their path. LUF conditions after the nuclear shot are not likely to be the same as those of the predicted LUF.

7. Honolulu to San Francisco Circuit Path (Figures 123-128)

a. Teak (Figures 123-125 and Table V)

(1) This circuit path is 2400 miles in length and is the most active from Honolulu. It is used by ACAN, AT&T, CAA, AACCS, RCA, Mackay Radio, and Globe Wireless. This circuit path is subject to multi-pathing because of the possibility of permitting more than one mode to be received at low angles of arrival. On the charts the predicted monthly average MUF and the MUF computed from Maui vertical incidence ionospheric data, hereafter known as the Maui radio day MUF, do not differ very much up to shot time. When shot time occurred, the lack of usable vertical incidence data caused the Maui radio day MUF to be suddenly discontinued at 28 mc. The Maui radio day MUF reappeared about three hours later at about 6.5 mc. The monthly average MUF predicted for this time of day is about 19 mc. The disturbed condition of the ionograms after the Teak shot

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made it impossible to plot the Maui radio day MUF for the three hours after shot time. For about an hour and twenty minutes, the Maui radio day MUF hovers around 6 mc. During the next three hours, the Maui radio day MUF climbs from 6 to 22 mc and circuits affected by Teak recover communication.

### (2) Honolulu receiving (Figure 124)

(a) Reference to Table V shows that prior to shot time there was no unusual difference in the number of accumulated hours of outage and in the number of frequency changes for the total hours of transmission time by ACAN-SSB, ACAN-CSRTT and AACSS-SSB. After shot time, Table V shows that for the remainder of the radio day, AACSS-SSB had accumulated four hours and fifteen minutes of outage ascribed to propagation difficulties and eight hours and fifty-five minutes of successful communications and time for frequency changes after trying five frequency changes. Neither ACAN-CSRTT or ACAN-SSB report any propagation outage after the Teak shot. Nominally, time taken for frequency changes is about fifteen minutes and this time is not shown in every instance as part of the outage time.

(b) With the same type of sixteen channel SSB modulation and with about the same kind of antennas, ACAN-SSB used four kw of power whereas the AACSS-SSB used two kw of power. Both circuits operated for a time after the Teak shot at about 7 mc. The major difference is the advantage of increased power on the ACAN-SSB circuit. The ACAN-CSRTT circuit had the advantages of operating at a still lower frequency of 5.1 mc and using a type of service that proved more reliable than SSB operation.

### (3) San Francisco receiving (Figure 125)

(a) Reference to Table V shows that in this transmission direction the ACAN circuits were again less affected by the Teak test.

(b) The same comments that apply to operation with Honolulu receiving apply to San Francisco receiving when considering the reasons that AACSS-SSB had more communication difficulties than either ACAN-SSB or ACAN-CSRTT. It is to be noted that the outage as a result of Teak with San Francisco receiving was observed about an hour after shot time.

### b. Orange (Figures 126-128 and Table V)

(1) For most of the time prior to shot time, the monthly average MUF and the Maui radio day MUF do not differ greatly. Just prior to shot time, the Maui radio day MUF peaked at 37 mc while the monthly average MUF reached a maximum of about 24 mc. When shot time occurred, the disruptions to communications were not as extensive on this path as with the Teak shot. After shot time, the Maui radio day MUF decreases more rapidly with the passage of time than the predicted monthly average MUF and also drops to a much lower frequency. The major disruptions occur with the coming of dawn near the Honolulu area. The f-min rises after daybreak to an unusually high frequency level. The result is increased propagation outage over the next several hours. This absorption outage affects the various circuits at different times and for varying

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durations. Between 1500 and 2000Z, the Maui radio day F-layer MUF is disrupted by the absorption effect. The Maui radio day sporadic E-layer MUF is disrupted apparently by absorption until 1800Z.

(2) There are two effects of Orange. The first effect was the disturbance of the ionospheric layers in the vicinity of the shot area. One of the results of this effect is the inability of the ionosphere to refract a wave front in the normal manner after the turbulent disturbance by the high altitude nuclear blast. When the nuclear-blast-induced turbulence subsided, reliable communication was restored when undisturbed propagation support of the ray path was reestablished. The nuclear blast took place at about midnight Hawaiian Standard Time. Over the next six hours, the rising fireball and the radiation from it produced a large region with an excess of negative ions. The second effect was the signal absorption resulting from the release of an excessive quantity of electrons by photodissociation of these negative ions with the appearance of sunlight. The second effect took place about six or more hours after the first effect. Both of these effects are evident on Figures 126-128.

(3) Honolulu receiving (Figure 127). Reference to Table V shows that in this transmission direction the ACAN circuits were less affected by Test Orange than the AACS circuit.

(4) San Francisco receiving (Figure 128). Reference to Table V shows that in this transmission direction the ACAN circuits were again less affected by Test Orange.

(5) Since the engineering factors for these circuits during Orange were the same as they were during Teak, AACS-SSB continued to show performance inferior to ACAN-SSB and ACAN-CSRTT. ACAN-CSRTT had no propagation outage with Honolulu receiving and thirty minutes of propagation outage with San Francisco receiving after the Orange shot. The durations of the first and second effects of Orange were greater on AACS-SSB than on ACAN-SSB. The absorption effects are more likely related to the ionosphere near Honolulu than to the ionosphere near San Francisco.

### 8. Honolulu to Tokyo Path (Figures 129-134)

#### a. Teak (Figures 129-131 and Table VI)

(1) This path is about 3850 miles long and is subject to multipathing because of the possibility that more than one mode can be received at low angles of arrival. The effects of Teak are immediate and are felt on many circuits for as much as nine hours after shot time. This path has circuits used by ACAN, US Navy, AACS, and CAA. CIA and AVCO made signal strength recordings of transmissions on this path.

(2) Effects (Figures 130 and 131). Reference to Table VI shows that in this case also, for both directions of transmission, the ACAN circuits suffered less outage as a result of Teak than the AACS circuit.

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(3) Signal reception at Honolulu suffered less from propagation outage due to Teak than did signal reception at Tokyo. In general AACSS-SSB was more vulnerable to propagation outages due to both natural causes and the effects of Teak than either ACAN-SSB or ACAN-CSRTT. ACAN-SSB used more transmitter power for the same type of modulation than AACSS-SSB. CSRTT proved to be a more reliable type of modulation than SSB for overcoming propagation difficulties. Also it may be said that ACAN-SSB possibly made a more nearly optimum use of its frequencies, and Air Force teletype terminal equipment is possibly more vulnerable to bias and distortion errors.

### b. Orange (Figures 132-134 and Table VI)

(1) The disruptions to communications by the effects of Orange are roughly equivalent on both directions of transmission between Honolulu and Tokyo. The discussion that appears in paragraph 7 b (2) above concerning the effect of Orange on the Honolulu to San Francisco path applies to this path as well. The easterly control point of the Honolulu-Tokyo path lies closer to and more in line with the disturbances emanating from Johnston Island than does the control point of the San Francisco path. This circumstance may partially account for the inferior performance of the Tokyo path.

(2) Effects (Figures 133 and 134). Reference to Table VI shows that the ACAN circuits in both directions again were less affected by the results of the blast than were the AACSS circuits.

(3) In particular, the major difference was the greater power used by ACAN-SSB for the same type of modulation and very nearly the same antenna characteristics. Again it may be that ACAN-SSB made a more nearly optimum use of its frequencies with hours of operation, and Air Force teletype equipment is possibly more vulnerable to bias and distortion errors.

### 9. Honolulu to Okinawa Path (Figures 135-140)

#### a. Teak (Figures 135-137 and Table VII)

(1) This path is about 4650 miles long. The effects of Teak are almost immediate and are felt on the ACAN and AACSS circuits for as much as ten hours after shot time. Refer to earlier comments on Teak for the Honolulu to San Francisco and Honolulu to Tokyo Paths for the discussion of the Maui radio day MUF and the significance of the comparison of the  $f_{min}$  with the LUF. Again the ACAN circuit in each case suffered less outage as a result of the Teak blast than did the AACSS circuit. See Table VII for a summary of these results.

(2) Again it can be said that with the same type of modulation and nearly the same antenna characteristics, ACAN-SSB was less subject to propagation outage than AACSS-SSB because its transmitter power was greater; it possibly made a more nearly optimum use of transmitter frequencies with hours of operation; and its teletype equipment is possibly less vulnerable to bias and distortion errors on SSB circuits.

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### b. Orange (Figures 138-140 and Table VII)

(1) The disruptions to communications by the effects of Orange are greater than by Teak for ACAN-SSB and less for AACSS-SSB with Okinawa receiving. However, ACAN-SSB did not suffer from propagation outage as much as AACSS-SSB in either direction. Refer to previous discussions of the effects of Orange on the Honolulu to San Francisco and Honolulu to Tokyo Paths.

(2) While the improvement in maintaining communications by ACAN-SSB compared with AACSS-SSB is not as great as in previous instances, a margin of difference still exists. It should be understood that the added degradation of propagation as a result of Teak and Orange rendered marginal even those point-to-point circuits which were adequate for undisturbed propagation conditions. The degree to which this marginal performance results in outage appears to depend on the safety factors used in the design of the circuits.

10. As much difficulty in multi-channel radioteletype communication has been described by various observers as being propagation outage caused by multipathing as outage caused by signal absorption under the circumstances of tests Teak and Orange. More reliable forms of modulation such as SSB voice, CSRTT and hand-keyed CW are less likely to be affected in readability by multipathing interference and by weak signals. The human operator of a CW receiving circuit can read and correctly receive messages thru interference and below threshold response levels of teletype machine equipment. Priority messages that require reliable reception under conditions similar to Teak and Orange should utilize these more dependable forms of modulation.

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### V. EVASION OF OUTAGES BY RELAYING

#### 1. Need for Relaying:

The onset of any large scale international emergency would result in the immediate generation of limited amounts of extremely high priority radio traffic. Established communication networks are designed to pass large quantities of traffic with tolerable delays, and with full regard for the individual interests of the various services and enterprises involved, both military and commercial. For emergencies, however, the need is for prearranged control of all existing facilities to yield immediate delivery of a few messages of extreme urgency. Just such a system of overall control is postulated in the following analysis of potential benefits to be expected from the assignment of all available circuitry to high priority traffic.

#### 2. Mode of Operation Assumed for Emergencies:

##### a. Specifically, let it be assumed that:

(1) Certain messages will have unquestioned priority status by their very nature.

(2) Any such messages will be clearly recognized as being of this nature, and yet will be so obviously linked to the special emergency situation that their possibility will in no way impede normal operations in the absence of emergency.

(3) These messages will not require authorization, or any prior processing or liaison activity. They can be directly sent, relayed, received, or delivered, subject only to limitations of propagation and equipment.

(4) All facilities, whether commercial or military, regardless of type of service employed, going anywhere or everywhere, will (if of adequate range and if currently functioning successfully) be at the complete and instant disposal of any such messages.

(5) All such facilities will be used to transmit the messages regardless of the performance or use of any or all of the others. All receivers which will receive these messages will directly dispatch them to all transmitters, which will retransmit them.

b. The general situation is one of a single message percolating through any and all links of a partially obstructed long range communications network which, in this case, is presumed to include every appropriate and functioning radio facility.

#### 3. Estimation of Relay Benefits.

a. For computational purposes, the links are considered to be available for all times in which their circuit logs noted successful reception, their capabilities being accumulated in units of frequency-hours, not of channel-hours or of circuit-path-hours. For example, on a circuit path from point A to point B carrying two-way traffic on 16 channel SSB,

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4 channel MUX, and 1 channel CS RTT, only six frequencies are nominally employed and continuous successful reception in both directions for one hour credits the path with six frequency-hours of capability. These frequency-hours are then treated as unit messages or units of information, with no provision at intermediate terminals for storage. The messages proceed by various possible alternate paths using no more than two relay points per path, the capacity of each path being limited by the capacity of its least capable link as expressed in frequency-hours. No more units are assumed to be sent to a relay point than can leave it, or vice-versa, but each point may serve more than one route. The total benefits from multiple relaying are then taken to be the summed capabilities of the various possible alternate paths.

b. No corresponding figure is presented for the total number of frequency-hours attempted during parallel relaying; during the initial stages of such operation it may be presumed that virtually all facilities in the network will be devoted to the effort regardless of whether their contributions prove ultimately to have been required. Rapid identification and release of redundant circuitry would drastically reduce the total number of frequency-hours involved in the transmission of the priority message. This process is highly dependent on specific conditions however, and is not predicted here.

c. It will be noted that two concepts in the evaluation of relay benefits are not mere simplifications, but are in contradiction to the conditions existing within the communications network. The frequency-quarter-hours of capability of the various circuit paths have been accumulated onto the synoptic maps on the basis of reciprocity, with no regard for actual directions of traffic flow. This ambivalence is carried into the application of the circuits as links in relay networks, for which purpose a strict adherence to directional capabilities would be more realistic. In addition, the totalled relay capabilities should reflect the joint contributions of the alternate paths. The process of combination should preserve the constricting effect of the less capable of the various intermediate links, but the data was not sufficiently accurate, complete, or controlled to permit a vigorous combination of probabilities. The restriction that no more message units may leave a relay point than can be sent to it has the desired effect of penalizing the totalled capabilities for the performances of their weaker links, although actual relay stations would not be restricted in their ability to duplicate incoming messages.

4. Application to Three Typical Circuit Paths. Since actual emergencies may not resemble the tests either in the number of blasts or in their placement, no detailed analysis of multiple parallel relaying has been prepared for every communication path concerned. Instead, three typical circuits paths have been selected to illustrate the orders of magnitude of the benefits to be expected from such stringent control of radio traffic during abnormal periods. These paths are San Francisco - Honolulu, San Francisco - Manila, and Guam - Honolulu.

### a. San Francisco - Honolulu, Test Teak

(1) This path has many well-engineered circuits and seldom dropped below 70 per cent effectiveness during hourly intervals soon after

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the first shot, with much higher percentages prevailing at earlier and later times. Inspection of the graph beneath Figure 142 shows this high ratio of successful frequency hours to the total number attempted, and also shows that the number of successful frequency hours could have been roughly doubled within any hour of the day by appropriate use of all available parallel circuitry using no more than two relay points on each of the additional paths. During the disturbed hours immediately following the shot an even greater relative increase in capability could have been obtained from such relaying. In the hour centered on Greenwich Noon only 68% of the frequency hours attempted were successful, but multiple relaying could have more than tripled the useful total.

(2) The parallel linkages contributing to the predicted total capability of the priority circuit generally consisted of all of the paths in and out of the priority terminals plus a considerably attenuated use of the rest of the network. Figure 141 contains a map and a diagram of the network of all the parallel routes which were considered in the computation of the total increases plotted in Figure 142. The individual links are numbered in accordance with the frequency-hours of successful operation experienced by each during the one-hour period centered on Greenwich Noon, 1 August 1958, a period selected as typical of early post-shot conditions. These frequency-hours are indicated regardless of whether they can contribute to the ultimate delivery of the priority traffic.

(3) In the diagram the network has been spatially rearranged to clarify the various possible interconnections which could aid transmissions between Honolulu and San Francisco. All links are again numbered in accordance with their successful frequency-hours within the interval. In addition, they bear in parentheses the number of frequency-hours contributing directly to the delivery of parallel-relayed priority traffic. The arrows indicate the direction of transmission along these contributing links of messages originating in Honolulu. When all traffic was arbitrarily assumed to have originated there, it is seen that a total of  $26 \frac{3}{4}$  units left this terminal. Eight of these units proceeded directly to San Francisco; the remainder scattered into the net via Anchorage, Manila, Okinawa, Taipei, and Tokyo. Although all the links converging on San Francisco could have provided a total of  $28 \frac{1}{2}$  frequency-hours, the capacity of the circuit was limited to the  $26 \frac{3}{4}$  which could have left Honolulu. Of these, six left Honolulu for Taipei. There was a direct route from Taipei to San Francisco capable in this hour of carrying one half of one unit, and there were similar routes to San Francisco from Guam, Manila, Okinawa, and Tokyo, each of which were directly accessible from Taipei. The link from Guam to San Francisco was completely out during this particular hour so none of the three frequency-hours which the junction at Taipei could send to Guam were able to continue on along to San Francisco without exceeding the permitted number of relay points. Of the two units which could be sent from Taipei to Okinawa, only one could continue to San Francisco. The two units each which could be sent to Manila and to Tokyo had direct routes of ample capacity on to their destination. In all, Taipei could have disposed of  $5 \frac{1}{2}$  units out of the 6 received from Honolulu.

(4) Similar examination of the other routes out of Honolulu proves them all to have been just capable of delivering their initial units without overtaxing the links into San Francisco. Other possible routing

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arrangements might have slightly reduced the number of units which required two intermediate relay points, but would not have recovered the lost one half of one frequency-hour. The total number of units leaving Honolulu was thus reduced from  $26 \frac{3}{4}$  to  $26 \frac{1}{2}$  frequency-hours. This total represents the relay assisted capabilities of the circuit, as opposed to the unassisted total of 8 frequency-hours out of  $11 \frac{3}{4}$  attempted.

### b. San Francisco - Honolulu, Test Orange

After the second shot, the performance of the circuit path gradually deteriorated until sunrise; daylight disrupted many of the services on this path and by 1900Z only  $8 \frac{3}{4}$  of the  $19 \frac{3}{4}$  frequency-hours attempted were successful. The use of multiple parallel relaying could have nearly doubled the capability of the circuit at this hour, providing a total of 17 frequency-hours. Refer to Figures 144 and 143, which plot these capabilities against time, both with and without relaying; and which also trace out the contributing network links for the hour interval centered on 1900Z. This route is considered typical of long Pacific paths of high traffic density which approach or traverse the region affected by the shot.

### c. San Francisco - Manila, Test Teak

(1) Prior to the first explosion, from three to five frequencies were successfully received in as many tries on this path. Relaying would have tripled the capability but was unnecessary. After the shot the proportional benefits from relaying were maintained and the need for them increased sharply during the next three hours. By 1300Z only three frequency-hours out of the eight attempted were successfully received in the hour interval. Relaying could have raised the total capability to ten and one fourth frequency hours. After 1300Z conditions improved. Refer to Figure 146.

(2) At 1200Z five units out of eight and one half were successfully received; relaying could have provided nine more for a total capability of fourteen frequency-hours. The contributions from the various links involved are charted in Figure 145, on the page facing the plot capabilities.

### d. San Francisco - Manila, Test Orange

The second explosion had virtually no effect on this circuit's capabilities; five frequency hours per hour were successfully received out of five attempted for seven hours following the test, and no outages occurred during the rest of the day. Relaying would have more than tripled this capacity. See Figures 148 and 147. This route is considered typical of long Pacific paths not directly traversing the shot area.

### e. Guam - Honolulu, Test Teak

Refer to Figures 150 and 149. This route is much shorter than the other two but crosses the shot area; for half a day preceeding the first blast only two frequency-hours per hour were attempted at most, and not always with success. Relaying would have greatly increased the capabilities of the circuit. Three hours before the shot the performance

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of the path declined; after the shot all the circuits along this path failed even though the reported total number of frequency-hours attempted rose sharply. The benefits which could have been realized from relaying were considerably reduced during this period as the parallel circuits encountered their own outages; however, relaying was always possible within the hour intervals to the extent of at least five frequency-hours per hour. Between 1600 and 2000Z original conditions were gradually restored. Figure 150 illustrates the capabilities and contributions of the relaying network during the hour centered on Greenwich Noon. Relaying could have added seven frequency hours to the capabilities of the circuit, thus providing in this particular case, the only successful communication.

### f. Guam - Honolulu, Test Orange

The second explosion found this circuit already experiencing moderate outages. Following the shot these outages did not appreciably increase but the improvements to be realized from relaying sharply decreased. Daytime conditions degraded the performance of the path until there occurred a complete failure of all of the three and one half frequency-hours attempted during the hour centered on 2000Z. Relaying benefits were also at a minimum at that time but still could provide eight frequency-hours. Refer to Figures 152 and 151. This circuit is considered to be typical of paths of moderate length traversing the shot area and requiring relaying in order to maintain communication.

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### VI DISCUSSION

1. In performing the analysis of the effects of the high altitude nuclear blasts of Teak and Orange on communication in the HF band, the sources of data employed were primarily the log records. Additional sources that proved less useful were magnetic tape recordings and Esterline Angus type paper strip charts. Two types of difficulties arose in organizing the data for analysis. One arose from the communication practices and jargon used by the operations staff monitoring a particular communication system and the other from the lack of supplementing the written and mechanically recorded log data with adequate reference information and scaling of measurements.

2. The difficulties arising from the variations of communication practices and jargon used by a particular communication system in monitoring its own operations required access to ACP and JANAP manuals and help by experienced communicators associated with the monitoring system. The initial step was the identification of these ACP and JANAP manuals and requesting these from their sources. This step was time consuming. The interpretation of specific practices required obtaining the help of an experienced communicator associated with the monitoring of each communication system. His interpretations helped to recognize that not all operators on duty were maintaining their logs in a uniform manner. Some of the operators on duty kept their log records in an individual manner that added difficulties to the analysis by use of modifications and self-generated abbreviations. Tracking down these interpretations and deviations were also time consuming. Liaison with representatives of the Army, Air Force, and Navy communication systems led to the discovery of the variability in human judgement exercised in the preparation of these logs. It is known that more than one technician had a hand in the preparation of the logs at any one fixed point station. Each military service supplied logs for a number of their fixed point stations. The technician preparing any of these log records could range from one with many years of experience in performing this duty and with a perceptiveness in recognizing and assessing improper behavior in equipment or difficulties in propagation conditions to one who is in an "on the job training" status. Yet in the log record, each man's entries carry the same weight. The manual of each military communication service shows that an experienced technician must have an extensive knowledge of the operating transmitters, receivers, teletypewriters, land-line equipment, etc. and operating procedures to properly assess the determination of operating conditions of a communication circuit. The reliability of using the logs as a basis of data analysis is reduced by the spread in human judgment exercised by the group of technicians that prepared these.

3. Another difficulty that arose with the log records was the appearance of entries in the log of a station at one end of a circuit that were not corroborated by entries in the log of the station at the other end of the circuit. For example the receiving log of one station often contained reference to a transmission incompletely or even differently recorded in the transmitter log of the other station, and vice versa. Since these logs originated in August of 1958, and the memories of operating personnel at this late date are unreliable, the decisions by the log analysts on this project had to be made arbitrarily in many instances.

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4. Supplementing the written and mechanically recorded log data with adequate reference information and scaling of measurements is both an administrative and technical responsibility that must not be overlooked. Without such complete reference information, the capability for analyzing the data is seriously degraded. It can be shown that such oversights were common in the written log records and mechanically recorded data. As far as possible and long after the fact so that memories were dimmed and some records were no longer available, serious efforts were made to obtain this missing reference information. Only partial success can be claimed for this effort.

5. Much of the mechanically recorded data by magnetic tape or paper strip chart had no significance because it lacked an identifiable reference level and a calibration scale. Furthermore, some mechanically recorded data which was identifiable proved to have been taken in a technically inappropriate manner. For example such data should be based on the received input signal and not on an output signal and accurate time references should be provided.

6. Not only should the reference data be for the calibration but it should also identify the equipment and circuit information. Each log sheet should be identified by circuit or route number, type of communication modulation technique, number of active channels, call letters, power of transmitter, transmitting and receiving antenna type and their dimensions, and any other special information of value to the test. In a great many cases identification information was lacking. Engineering changes were made at these communication installations from time to time both prior to and after the tests. If this reference identification information is taken later, it can and has been confused by engineering changes. This identification information is needed for analysis of equipment capabilities for the propagation conditions on the day of the test.

7. Finally it may be pointed out that to give added significance to synoptic data from a number of receiving and transmitting locations, uniformity of instrumentation and calibration techniques should be provided. This standardization requires planning but the rewards would justify it in significance of the comparisons.

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### VII. CONCLUSIONS

1. The effects of Teak on HF communication were intense, almost immediate, and widespread, impairing reliability of communication. Reliability of communication was impaired from Honolulu to San Francisco for as much as four hours after Teak and to Tokyo and Okinawa for as much as nine and ten hours after Teak, respectively.

2. Prior to the time of Orange, many of the circuits were troubled with propagation outages. On those circuits, the effects of Orange were not readily separated from those causes of propagation outage already there. It appeared that the severity of the propagation outages increased as a result of the shot within the general geographical area of Test Orange.

3. The first effects on HF communication of Orange were almost immediate and impaired reliability of communication on certain paths, but were not as intense or as widespread as the effects of Teak.

4. The "morning after" or second effects on HF communication of Orange impaired reliability of communication on various circuits for as much as twenty-four hours after the beginning of the second effect. The second effect began about six or more hours after the first effect with the particular times being strongly influenced by the time of sunrise within the affected region. The second effect was therefore considered to be caused by the absorption of signals as a result of the release of an excessive quantity of electrons by photodissociation with the appearance of sunlight on the diffused ions produced by the explosion.

5. During the time period of the effects of Teak and Orange, some successful communication activity on circuits within the affected area was distributed with considerable uniformity over the spread between the upper and lower limits of the HF band. In an overall sense, there is no general indication of an advantage in going to a higher or lower frequency within the HF band.

6. In no instance were all HF circuits into or out of any one communication center such as Honolulu, inoperative at the same time for any appreciable period.

7. When all communication was out on three typical paths in the vicinity of the shot, analysis showed that communication could have been provided by multiple parallel relaying.

8. On military HF communication circuits, CSRTT modulation appeared to be affected least, and SSB modulation appeared to be affected less than other forms of modulation.

9. Improved engineering factors, such as more powerful transmitters, more effective types of modulation and higher gain antennas for receiving and transmitting reduced the deleterious effects of high altitude nuclear blasts on HF communications. Back-up circuits, using manual keying of powerful transmitters can maintain reliable communication during highly disturbed conditions characterized by multipathing even when only a barely detectable carrier exists.

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### VIII SOURCES OF DATA

The data sources for this study are:

- a. Log records, strip charts and magnetic tape recordings supplied to AFSWP by the point-to-point circuits of the Army and the Air Force, and the shore stations of the Navy;
- b. Supplementary log records furnished by the point-to-point circuits of the Army and the Air Force;
- c. Log records of monitorings by the CIA of the Navy transmissions and by the Army of WWVH transmissions supplied to AFSWP;
- d. Letter reports of circuit outages by CAA; and
- e. Rand gathered data of commercial communication company experiences as reported by RCA, AT&T, Mackay Radio, and Globe Wireless.

This information was supplemented by access to ACP, JANAP, and other military documentation to identify circuits and interpret military communication practices of the Army, Navy, and Air Force point-to-point HF circuits.

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### IX ACKNOWLEDGEMENTS

This is to acknowledge the help provided and the patience exhibited in sifting through the data, helping to organize and analyze it, and reducing the sorted information into charts and tables by Mr. Henry H. Fleming, Jr, Mr. Richard F. McConnell, Mr. Albert G. Ehlert, Mr. James A. Stevens, Mr. Peter P. Martin, and Mrs. Florence Briller.

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## APPENDIX I

### DISRUPTION OF AIR TRAFFIC CONTROL OVER THE PACIFIC

1. The Artificially Induced Ionospheric Disturbance. In midsummer of 1958 two very high yield atomic weapons were exploded at such heights as to free them from the absorbing, damping, and generally constricting properties of the dense layers of the lower atmosphere. A large portion of the energy of these detonations was therefore available as radiation of X rays, ultraviolet light, and fast electrons. If unabsorbed by intervening layers of air, these rays so alter the normal structure of the ionosphere as to produce a localized but severe equivalent to a natural ionospheric disturbance. High frequency communications which depend upon orderly reflections from the affected portions of the ionosphere may then encounter drastic reductions in F-layer critical frequencies, highly absorbing D-layer ionization even at night, and intense sporadic E-layer activity. Such reflections as occur are apt to be very diffuse or scattered, the lack of a single dominant mode of transmission degrading reception of high-baud-rate transmissions even when adequate signal-to-noise ratios are maintained. However, voice transmissions also suffered; notably those concerned with the control of aviation over the Pacific Area.

#### 2. Significance of Simultaneous Outages.

a. From a global or long-term viewpoint, the actual combinations of yield and altitude employed in the tests were such as to produce relatively brief and local effects. Certain vital communications between aircraft and their ground terminals, and between ground terminals, traversed the affected region and were quite unable to tolerate the resulting protracted interruptions. Many of the point-to-point circuits in the vicinity are maintained by various military services; in times of emergency their traffic could be of the utmost urgency, and their reported outages must be so evaluated.

b. The disruptions to services associated with air traffic control produced by the first detonation were immediate, severe, clearly identifiable with the event, and not fully expected. They thus exhibit certain elements associated with operating conditions during any sudden, well-coordinated, and partially successful attempt to jam all communications within a particular area. The transient nature of these effects diminishes but does not eliminate the significance of any simultaneous communication outage.

3. Comments on General Data on Air Traffic Control Outages. Most of the data furnished for analysis concern the behaviour of point-to-point circuits. These reports are more factual than expressive, and the true impact of simultaneous outage on the routine operations of the communicator is more dramatically illustrated by the effects of the nuclear tests on flight scheduling of aircraft. The Rand Corporation and the Defense Atomic Support Agency have forwarded certain narrative material gathered from the files of the agencies concerned. Difficulties with communications were frequently compounded by the lack of available channels of administrative liaison, but propagationally induced losses of contact proved highly disruptive to aviation in the Pacific Area. The accompanying outages to military flights were of equally critical significance, inasmuch as the

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armed services now increasingly depend on sky-wave communications to be reliable and secure. In times of emergency the services are, therefore, severely affected by their loss. A brief summary of this narrative material follows.

### 4. Material Relating to Test TEAK

a. Prior to this first shot the CAA, the major air carriers, and their communications subsidiaries were notified that the test site should be avoided by at least 521 nautical miles, and that within this radius the hazards to aircraft and to personnel might be serious but would not be persistent. Planes were routed accordingly, but these precautions were not accompanied by any comprehensive briefing of the personnel directly involved in radio communications. One actual effect of the first explosion was to produce a severe but local ionospheric disturbance which rapidly spread beyond the radius mentioned in the official warning. Concurrently, a similar disturbance appeared in the region of the geomagnetic conjugate, disrupting communications between the Fiji Islands, Samoa, and New Zealand. Spectacular visible aurora appeared at both conjugate points but not at Canton Island, which lies between them. Likewise, all types of high frequency communication were immediately disrupted at both conjugate points, but local communications within the Canton Island area were maintained. Samoa was blacked out to all overseas points for over six hours, and to the Fiji Islands for over twelve. Aircraft traffic control was maintained with great difficulty at Nandi during the blackout. Australia and New Zealand, although well removed from the geomagnetic conjugate, also reported interference to their air-ground communications.

b. The exact times of failure of the air-ground circuits, and their actual circuit paths at these times, are not well defined since these facilities are used by moving terminals for brief and infrequent transmissions. Canton Island, which is 1900 miles SW of Honolulu, 1350 miles south of the explosion, and roughly on the geomagnetic equator experienced no difficulties with local air-to-ground traffic although it had trouble maintaining point-to-point communications. Guam, which is 3220 miles to the west, and Los Angeles, 2560 miles to the northeast, were likewise little affected. Wake Island, which has very nearly the same distances from Honolulu and from the explosion as has Canton, but which is west from these sites, lost contact with a total of 17 airplanes for more than 90 consecutive minutes. Honolulu maintained some semblance of traffic control in its area by using VHF and UHF, and by relaying messages from plane to plane. Wake Island was more limited in its VHF-UHF capabilities, but 12 hours after the blast did make an anomalous contact with a plane 750 miles due east on 121.5 mc. Possibly, the Hawaiian Islands enjoy much greater line-of-sight ranges than do the atolls because higher locations are available for the antennas; however, the statement is made that high frequency sky wave communications to aircraft out of Honolulu were little if any better than they were at Wake. The actual number of 90-minute alerts in the Honolulu area was not given but was stated by Aeronautical Radio Inc. to represent about ten percent of all of the flights for a period of 12 to 14 hours following the blast. Voice communications between Honolulu and Wake Island using the air-to-ground equipment failed for about 14 hours.

c. Most of the failures when originally reported by the air-to-ground terminals occurred on the usual frequencies of 8 to 13 mc, but both

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higher and lower frequencies were soon tried. Whether such changes brought any consistent benefits is doubtful, and temporary restoration of service would depend on whether the circuit had been first affected by the rising absorption or by the diminishing support.

d. The 90-minute alerts do not offer a proportional index to propagation difficulties since they arise only from very protracted outages and may be lifted by brief or deviously relayed reports. They do provide a measure of the disruption of normal operations, the CAA and the airlines taking a very serious view of such status even when applicable to but one aircraft. Apparently the normal procedure is to intercept the flight with another airplane on the premise that the trouble may be equipmental or that the first flight has met with some misfortune. One such intercept mission is stated to have promptly lost contact with its base, becoming in due time just one more of the many 90-minute alerts. There is no mention of any more such missions, and the CAA later reached the opinion that traffic control and flight-following search and rescue services were impossible under such conditions.

### 5. Material Relating to Test ORANGE

a. The widespread inconveniences imposed by the first explosion on civilian agencies, with the ensuing publicity, led these agencies to press for wider dissemination of advance notices concerning the probable effects on communication of the second blast. The announced hazard radius for this shot had been reduced to 435 nautical miles, but Pan American Airways, for one, had decided to ground all its aircraft in the Pacific for four hours after the blast since certain expert advice had indicated the likelihood of a blackout over the entire area for this period. An eighteen-hour warning prior to the scheduled time of the shot was accompanied by permission to alert the operators, who diligently sought out reportable phenomena and interruptions. It was highly unlikely, therefore, in this second test, that any such occurrences could pass unnoticed if they were of significant magnitude, duration, and geographical extent.

b. As in the case of the first test, the second was detonated in the middle of the local nighttime. Brief fades were noted, audible "clicks" or "thumps" appeared on monitored circuits at the exact time of the blast, but traffic was not disrupted. The immediate effect on communications of this lower explosion was well illustrated by the report of an operator who was attempting to take a LORAN fix on Hawaiian stations from a point 1180 nautical miles from Honolulu towards Los Angeles. At precisely the published time of detonation, the LORAN signals gradually faded and completely disappeared for 30 seconds, then reappeared as a clutter of pulses which were unmatchable between master and slave station. This effect persisted for about one minute, and was followed by a brief period in which the two stations each exhibited matchable pulses accompanied by signals which were identified by the operator as representing "ground wave" propagation. Three minutes after the blast conditions became perfectly normal, at which time the high frequency receivers were monitored and found to be unaffected. The operator stated that he had not previously encountered ground wave signals at night at such a range. Similarly, AACS at Honolulu noted a very brief drop-out of the MUX circuit to Kwajalein on 17 mc, while the SSB circuit to Guam on 20 mc and the RTT circuit to Christmas Island on 10 mc showed no apparent effect at blast time. Except for such sporadic

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observations of very minor failures exactly coincident with the shot, the high frequency aircraft control circuits into Honolulu were continuously monitored during the next hour without serious degradation in performance observed, at which time all special precautions were discontinued. The usual pre-dawn dip in F-layer support frequency was severe, but no real trouble was suspected until the local sunrise brought a steadily increasing number of uncorrectable outages. Simultaneously, ionospheric sounders in the area noted a rapid rise in absorption levels; this excessive absorption blanked out most of the soundings taken during the period of least F-layer support. At the geomagnetic conjugate Apia and Nandi reported that high frequency circuits were unaffected but that the lower frequencies, which are more readily absorbed, were unusable.

c. Some of the disruption of ground-to-air communications was the indirect result of concurrent point-to-point outages. Honolulu AACS reported "Equipment malfunction at this and other stations accounted for some inability to maintain contact. " "----when the high side of the band went out the low side was generally good." "Frequencies in the 3 to 9 mc band appeared most reliable in the period 0700 to 1300Z, and in the 10 to 18 mc band during the period 1300 to 0700Z." "We were to a reasonable degree able to maintain communications with adjacent air-to-ground stations on air-to-ground frequencies." "----communications built up to a peak at about 1000Z (12 Aug) then deteriorated to almost a complete blackout at approximately 1700Z and continuing through 0100Z (on the 13th)."

d. A more general report on air-to-ground communications indicated that the major trouble was encountered in the Honolulu area, starting as early as 1400Z of the 12th of August, improving at 2300Z and becoming normal at 1300Z of the next day. Conditions were worse on transmissions to the west and south of the islands, better to the east, while San Francisco reported no significant effect on its air-to-ground messages. During the troubled 24 hours Honolulu accumulated 24 alerts, ten of which involved civil aircraft, and one of which lasted four and one half hours. Wake Island, which had been so disrupted in its air-ground capabilities during the first test, reported only intermittent outages during the 24 hours following the second and was able to relay messages to Honolulu from planes which had lost contact with the latter terminal. San Francisco was also able to relay position reports.

e. The crisis at Honolulu peaked during local mid-morning, with serious difficulties becoming apparent by 1730Z; a complete blackout of air-to-ground communications in all directions developed an hour later, with the result that trans-oceanic air traffic out of the area was suspended at 2035Z. Shortly after (local) noon conditions began to improve slightly, first towards the east; by mid-afternoon nearly normal operations became possible, but flight separation restrictions remained in force out of Honolulu until 0715Z.

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## APPENDIX II

### DISTANCES AND AZIMUTHAL DIRECTIONS

The Distance From Honolulu To:	Distance		Azimuth Angle from Honolulu in Degrees
	in Miles	in Km	
Los Alamos	3250	5230	60° 16'
Washington D.C.	4833	7778	55° 00'
San Francisco	2394	3852	53° 41'
Anchorage	2776	4467	5° 52'
Adak	2410	3875	339° 03'
Tokyo	3837	6175	299° 30'
Shanghai	4970	8000	297° 10'
Midway	1296	2086	293° 31'
Okinawa	4655	7490	290° 52'
Formosa (Taipei)	4978	8011	290° 50'
Manila	5290	8515	280° 41'
Wake Is.	2293	3697	274° 04'
Guam	3788	6097	271° 49'
Eniwetok	2710	4365	262° 06'
Kwajalein	2442	3930	255° 04'
Johnston Is.	811	1306	250° 11'
Sydney	5073	8164	228° 59'
Nandi, Fiji Is.	3193	5139	216° 52'
Canton Is.	1901	3059	211° 15'

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## APPENDIX III

### DISTANCES AND AZIMUTHAL DIRECTIONS

The Distance From San Francisco To:	Distance		Azimuth Angle from San Francisco in Degrees
	in Miles	in Km	
Ft. Sam Houston	1490	2395	105° 55'
Washington	2439	3925	74° 18.5'
Chicago	1851	2979	69° 48'
Seattle	680	1100	0° 04'
Anchorage	2000	3215	332° 59'
Seoul	5604	9018	311° 30'
Hong-Kong	6895	11096	308° 19'
Formosa (Taipei)	6435	10357	305° 24'
Tokyo	5113	8229	303° 48'
Okinawa	6090	9801	302° 32'
Manila	6960	11200	298° 11'
Bandung	8649	13920	291° 12'
Guam	5830	9385	282° 19'
Honolulu	2394	3852	251° 47'
Sydney	7420	11942	240° 20'

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**KEY TO FREQUENCY UTILIZATION BAR CHARTS OF COMBINED  
CIRCUIT EXPERIENCE VS FREQUENCY LIMITATIONS**

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Circuit Experience:


KEY A


Circuit { Passed.....  
Failed\_\_\_\_\_

Bars are plotted for periods of successful reception or of outages definitely attributed to propagation conditions. Length of bar corresponds to the duration of circuit conditions. For all other interruptions the bar is omitted.

Frequency Limitations:

MUF  Observed  $F_2$  MUF from Vertical Incidence Data

 Observed  $E_s$  MUF from Vertical Incidence Data

LUF  Observed  $F_{min}$  from Vertical Incidence Data

Notes:

Observed values apply to Date of Chart.  
Observed values based on Vertical Incidence Data.  
Data taken at ionosphere station identified with communication area for which the individual graph is prepared.

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

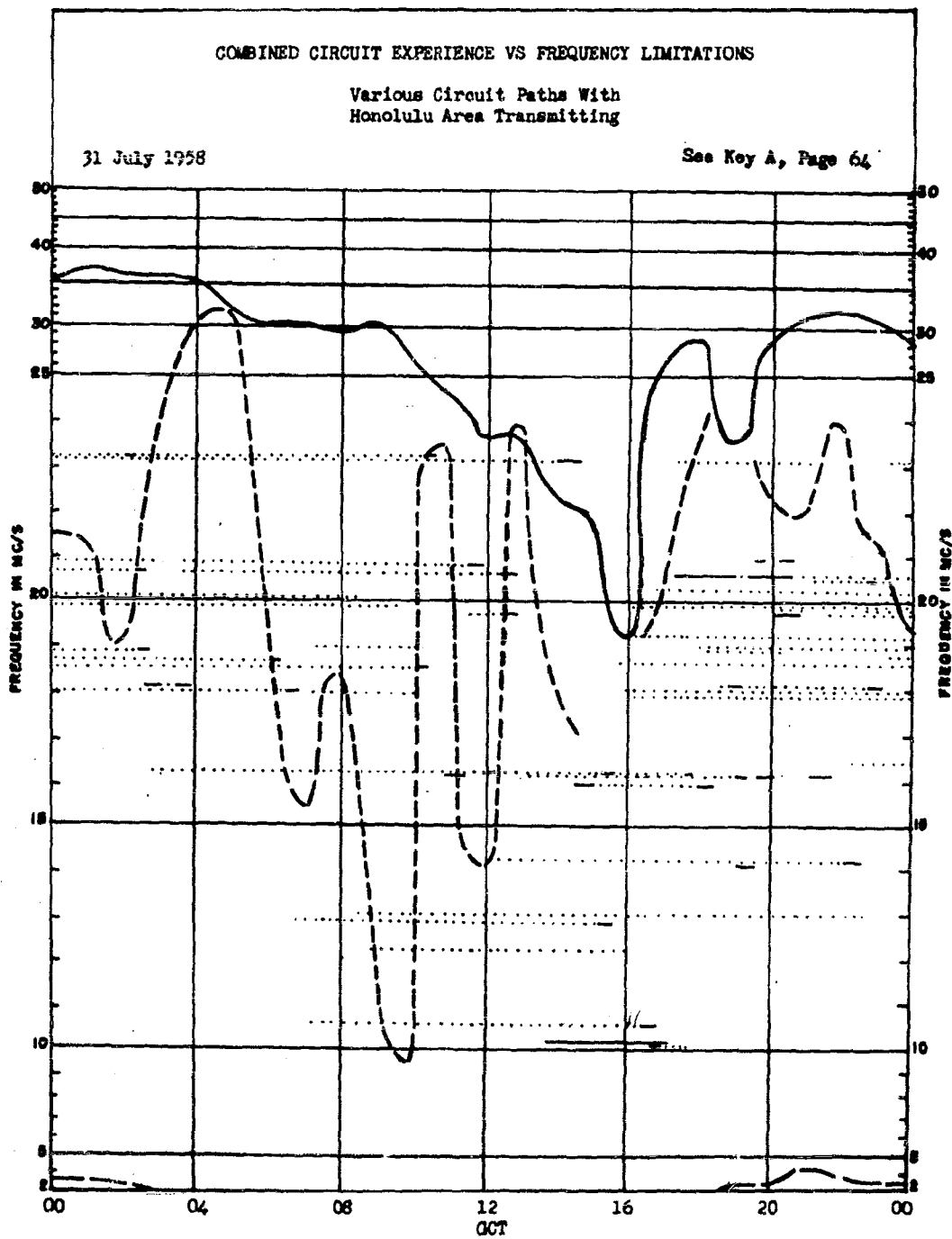


Figure 1

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

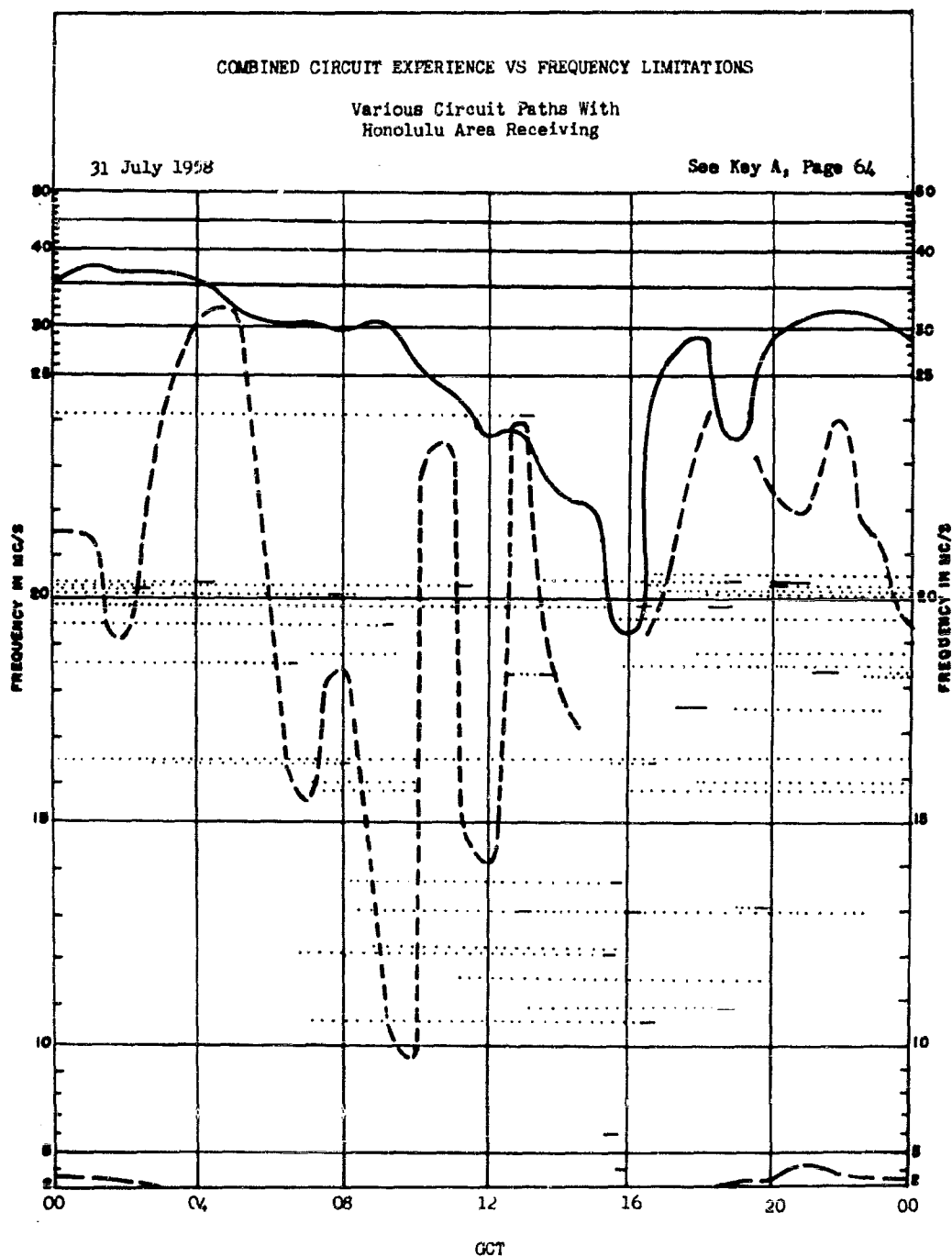


Figure 2

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

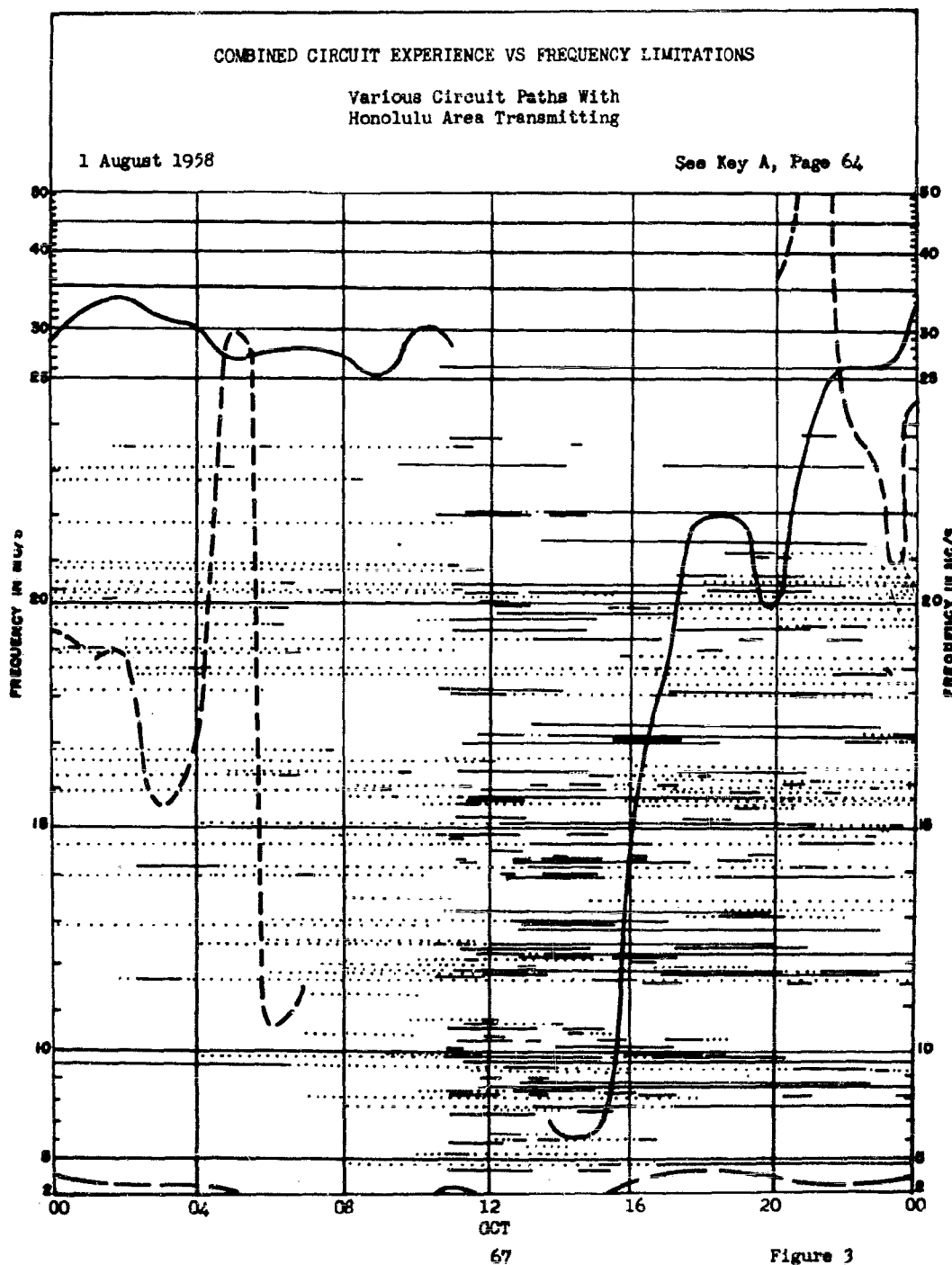


Figure 3

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

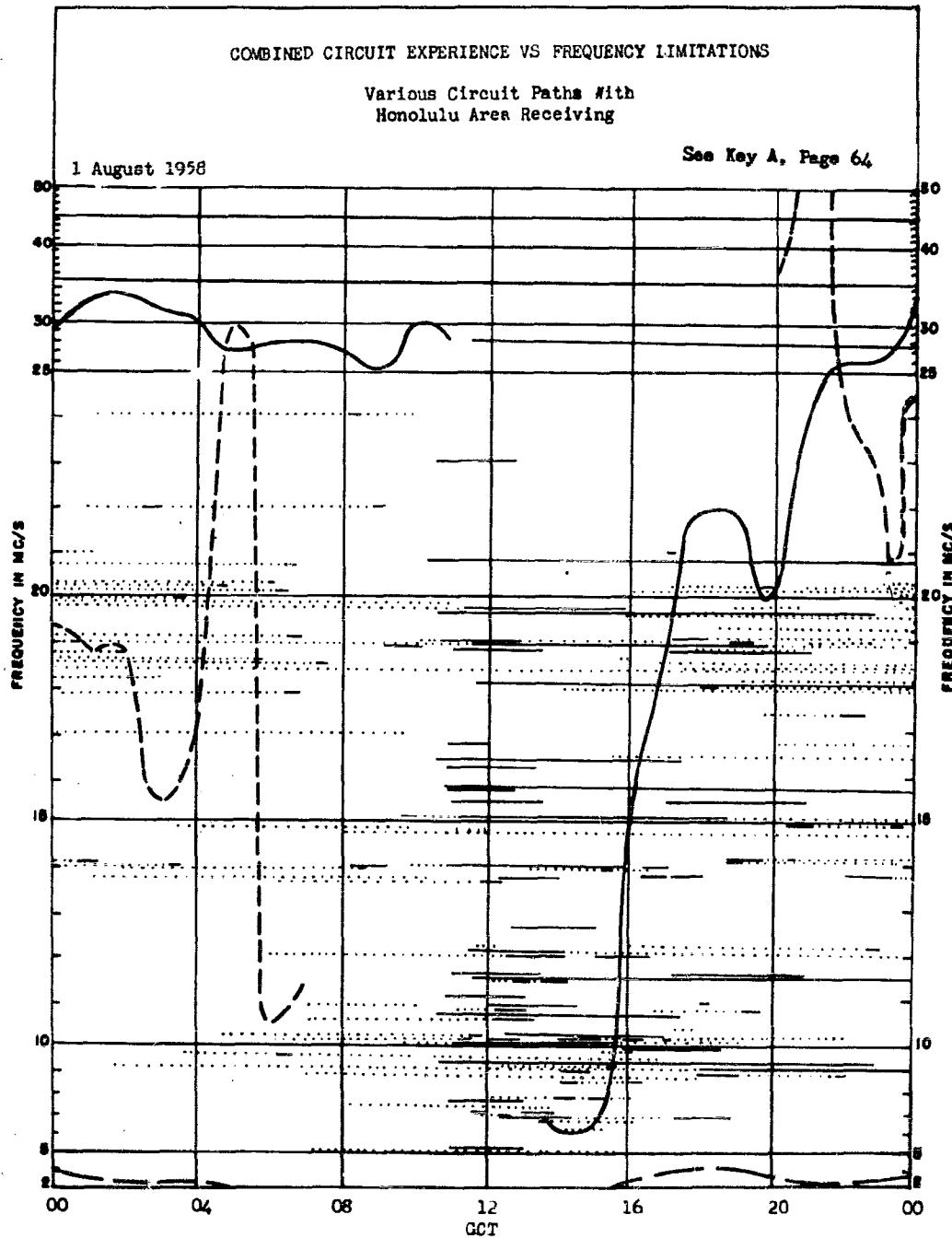
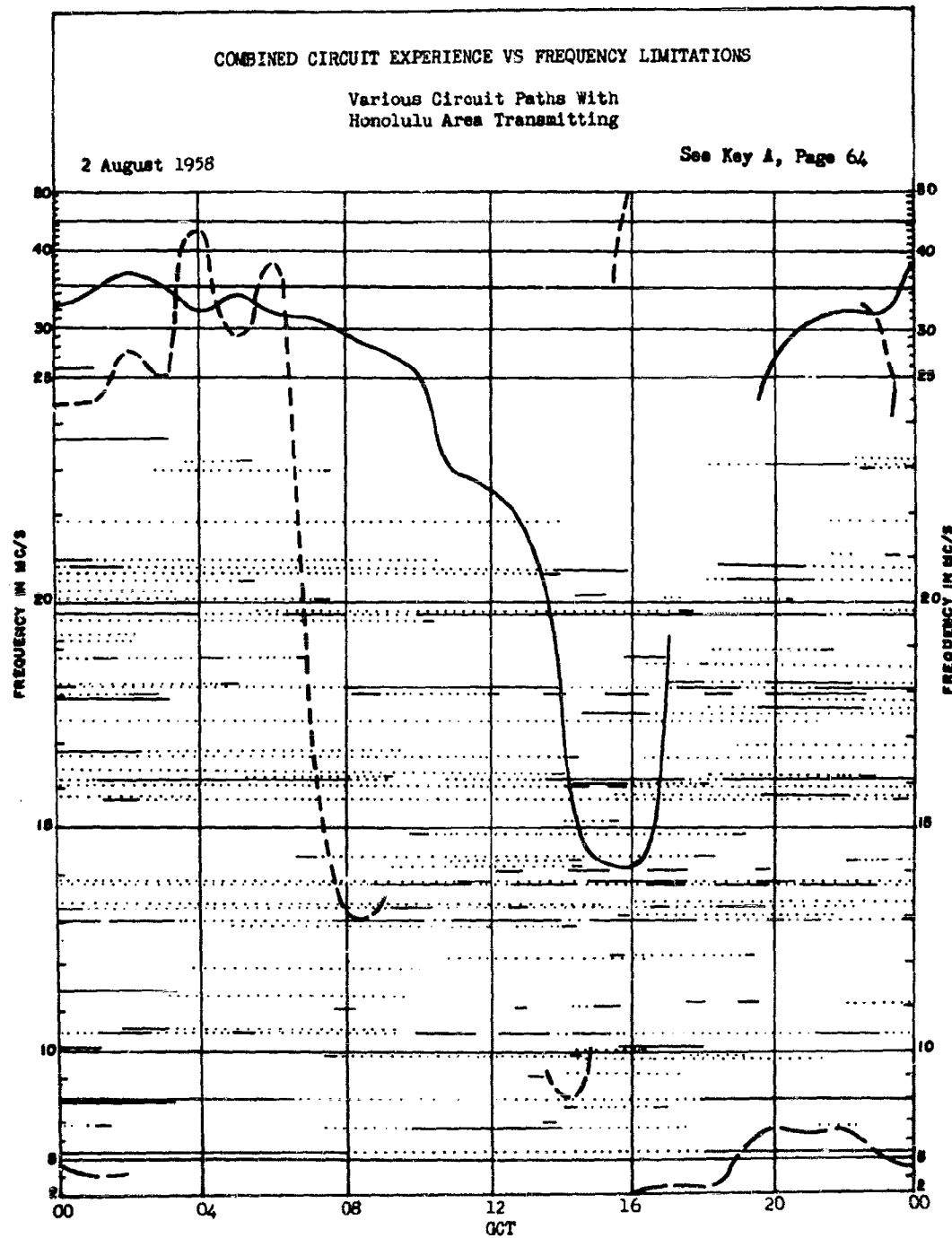


Figure 4

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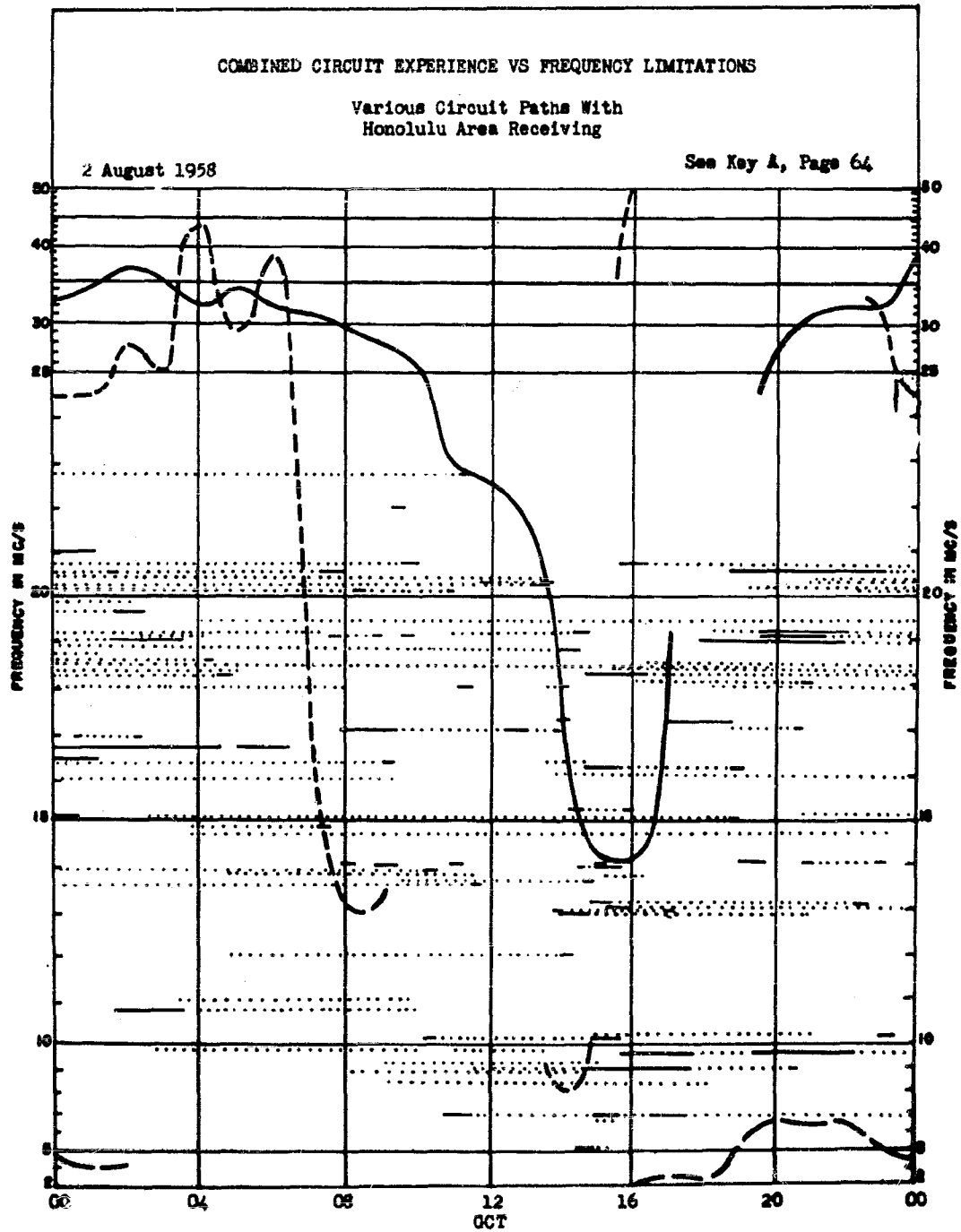
U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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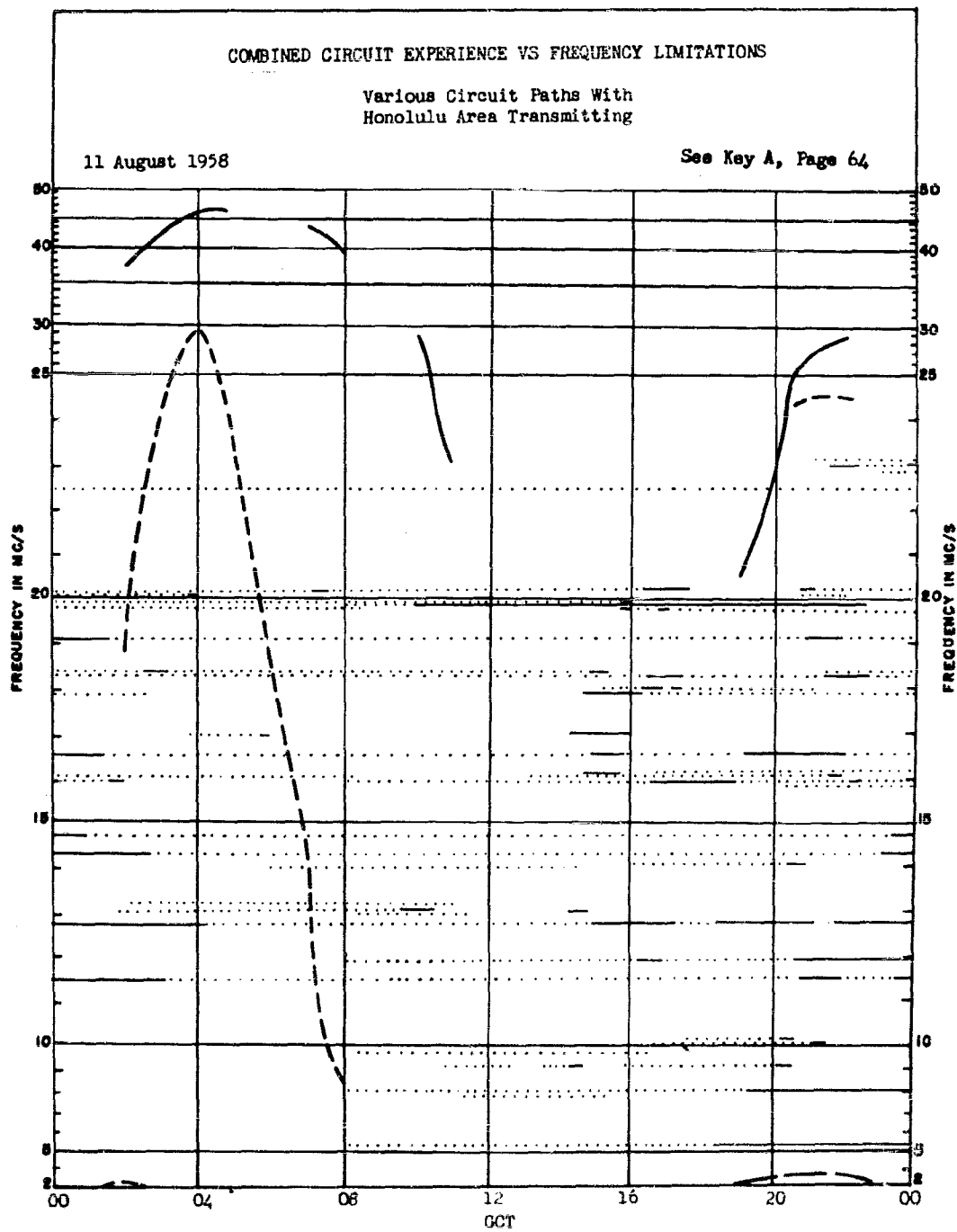
U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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Figure 7

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

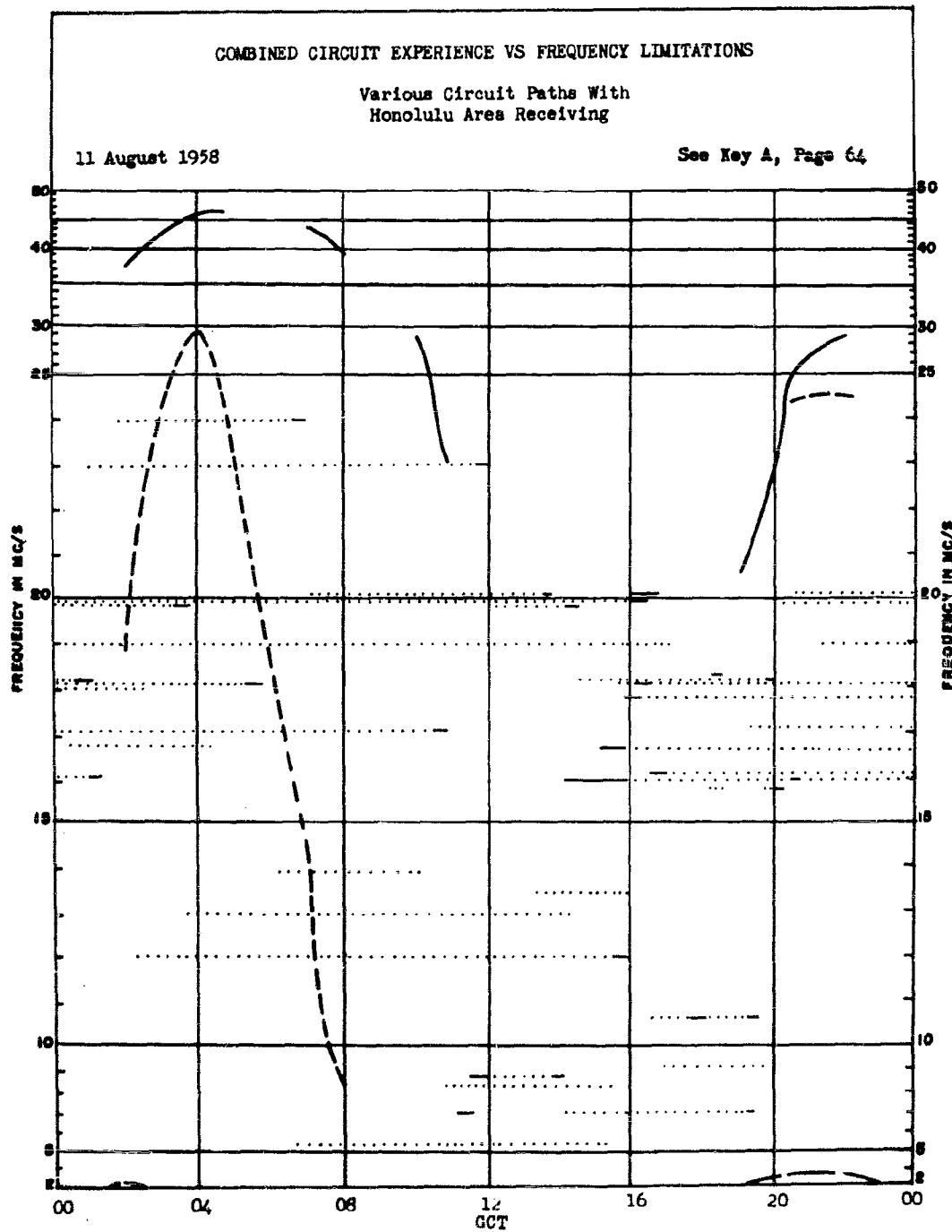


Figure 8

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

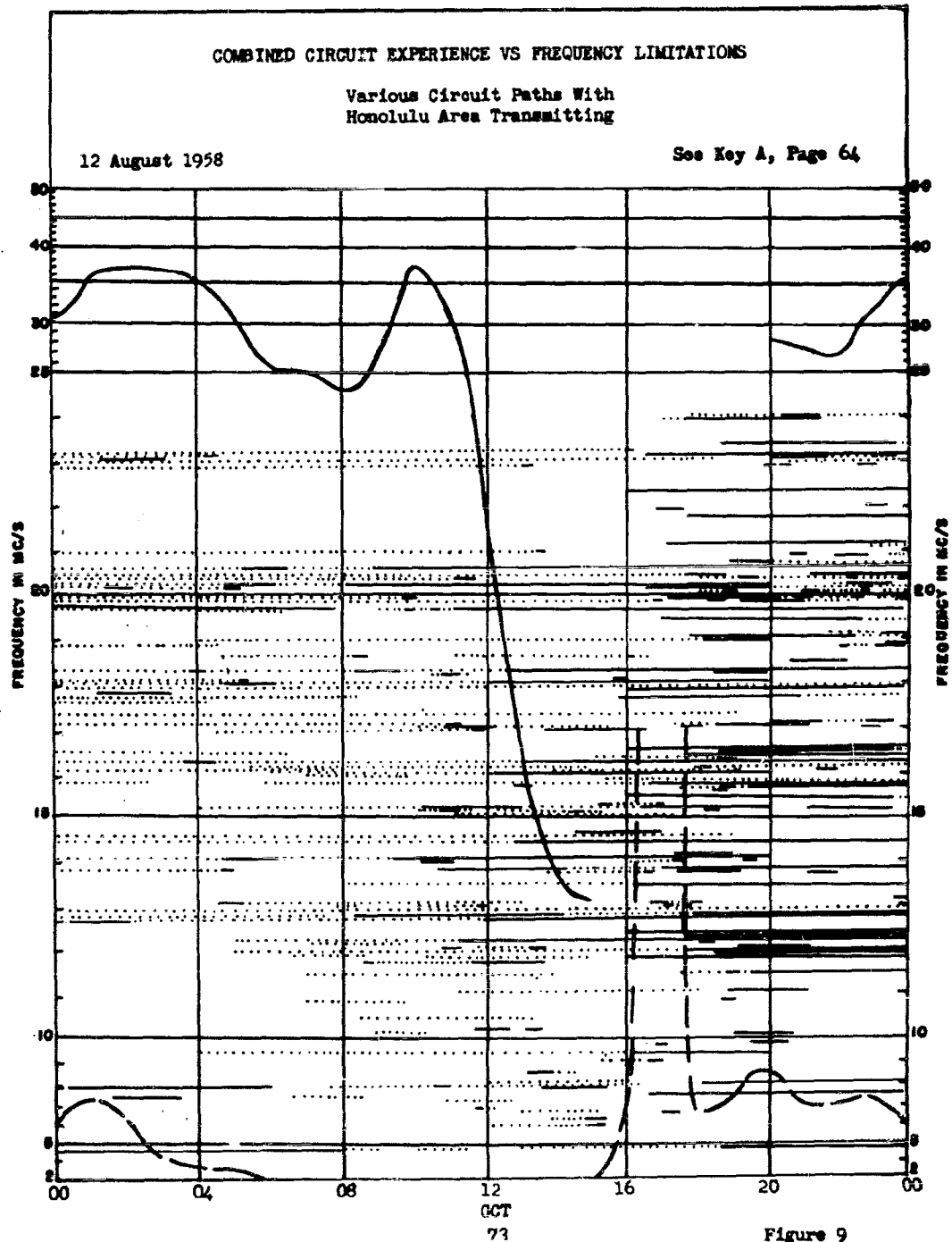
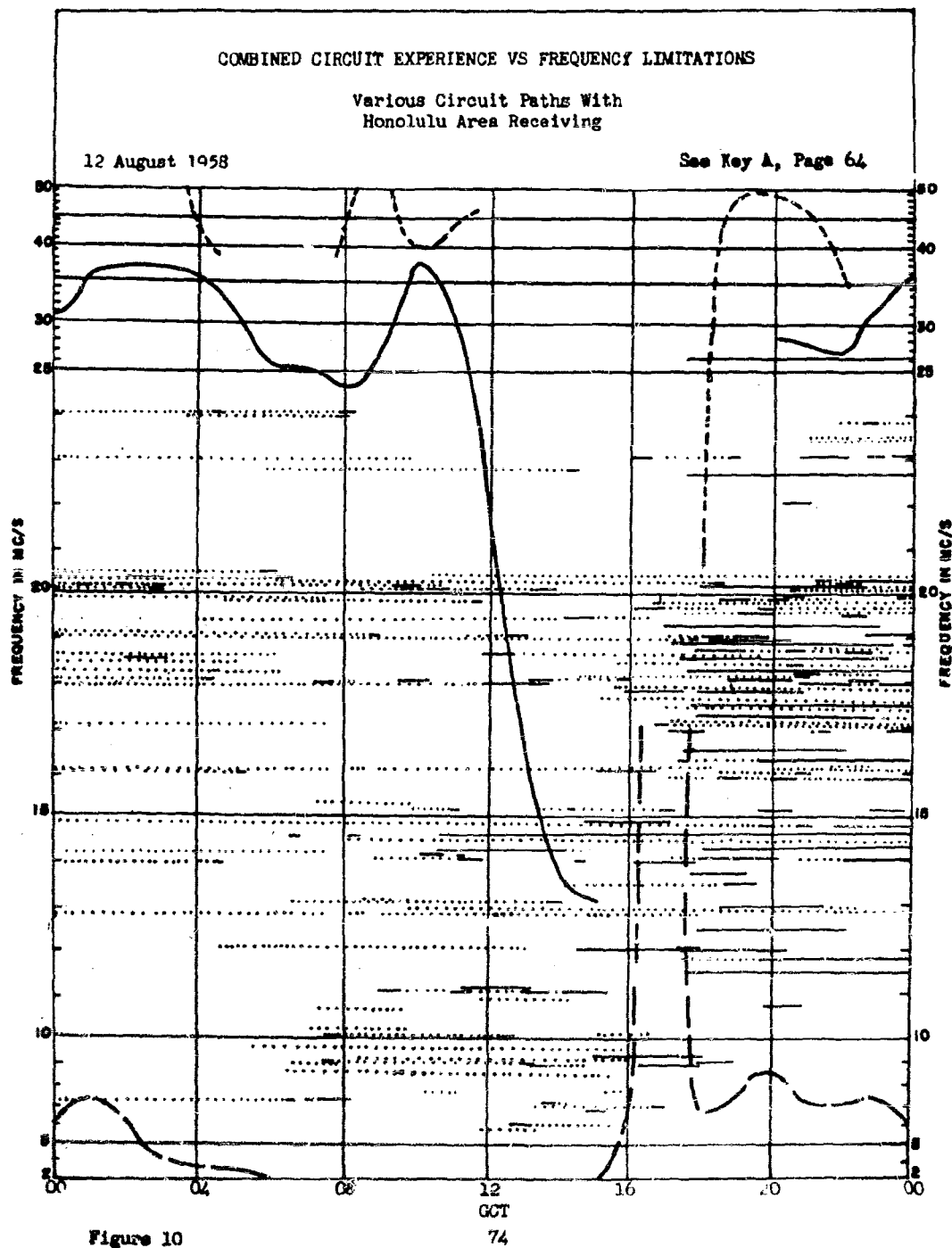


Figure 9

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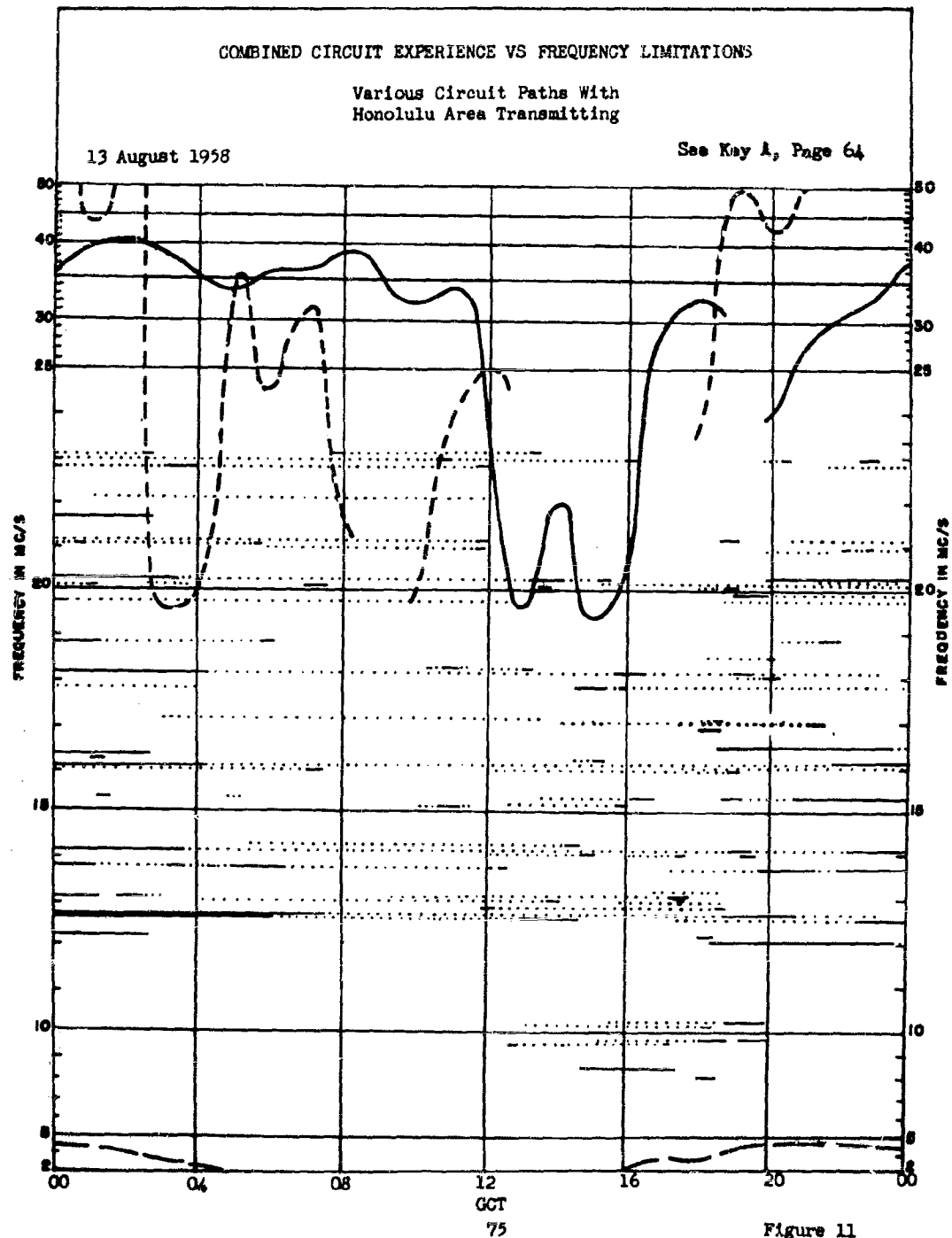
U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

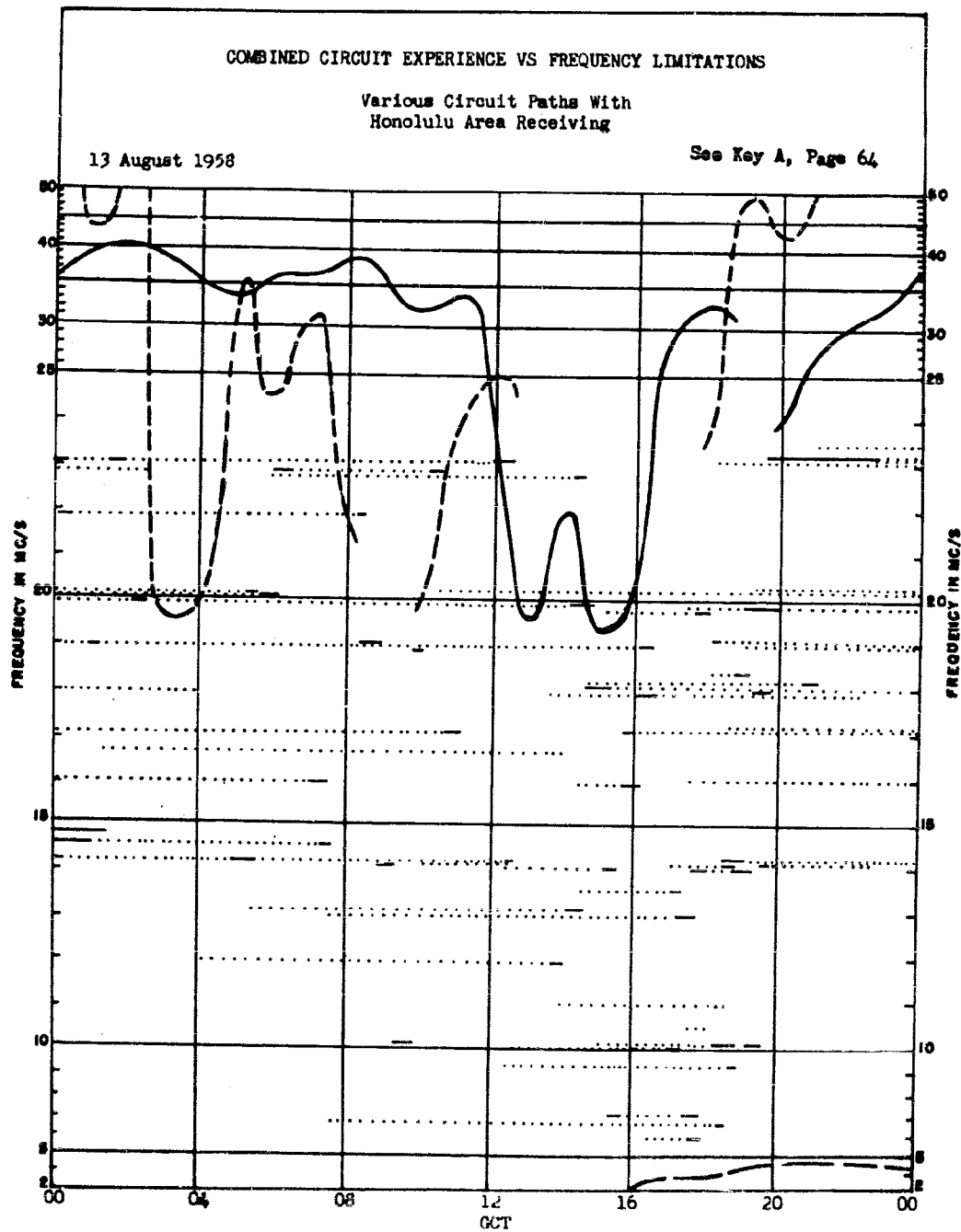
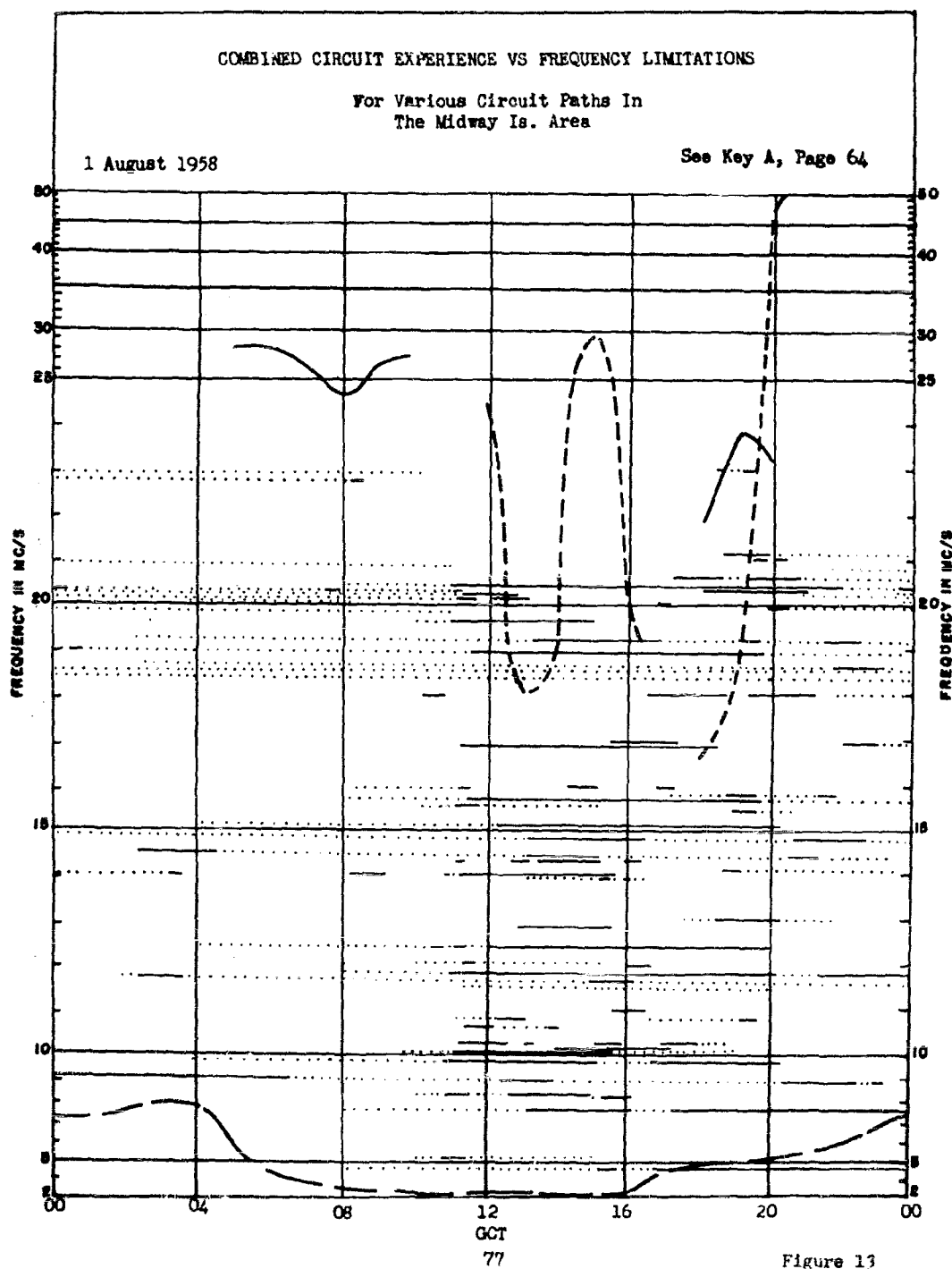


Figure 12

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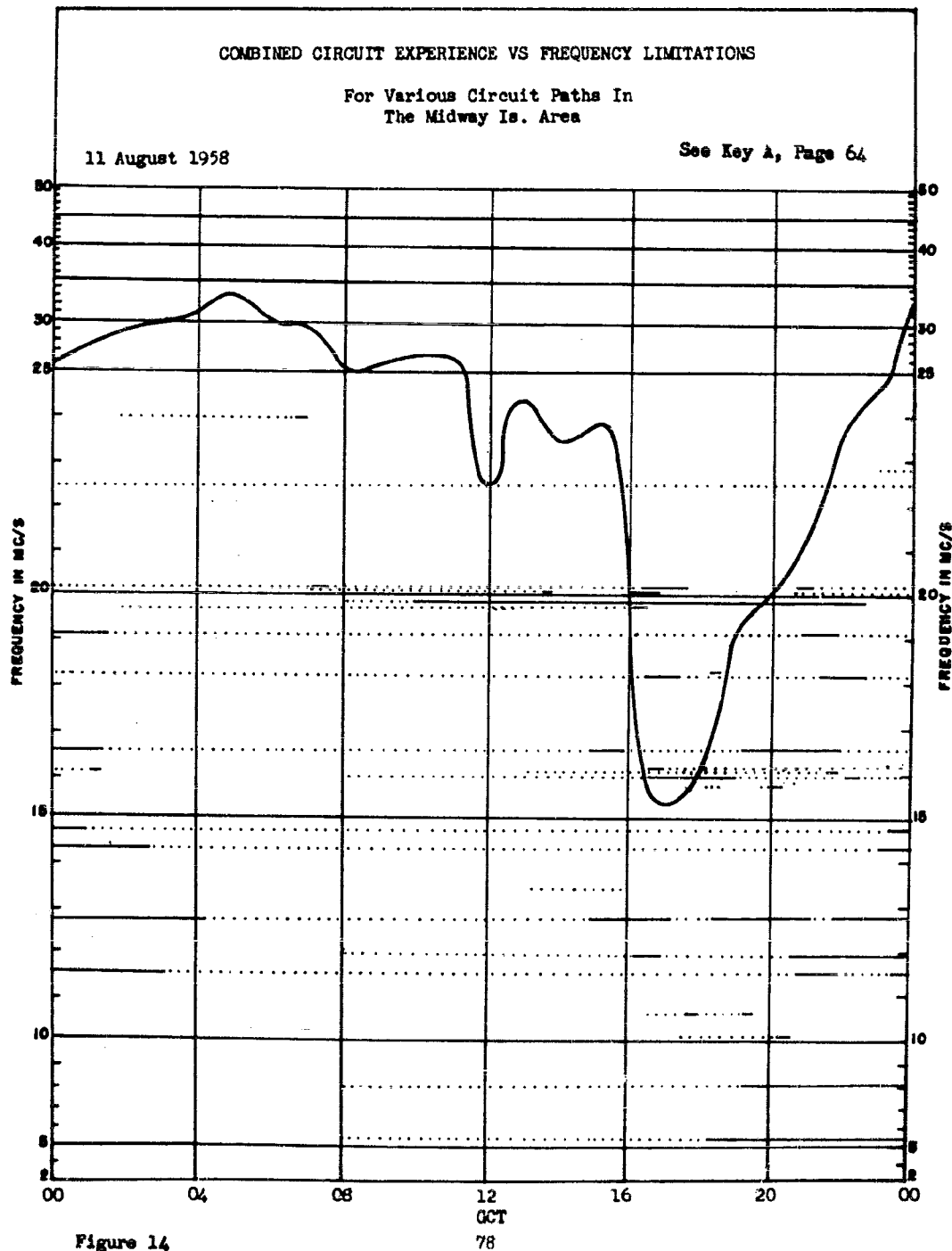
U. S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U. S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

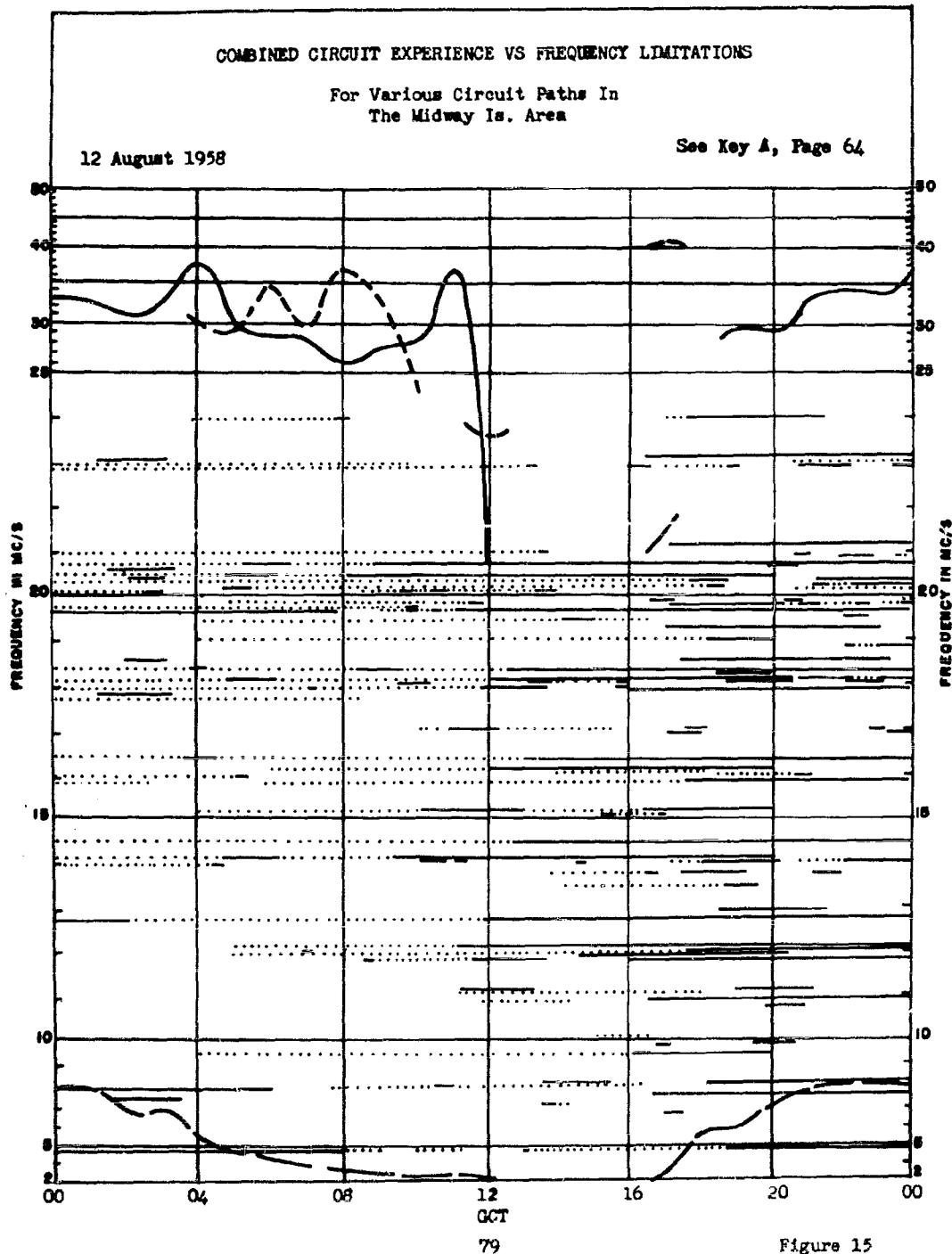


Figure 15

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

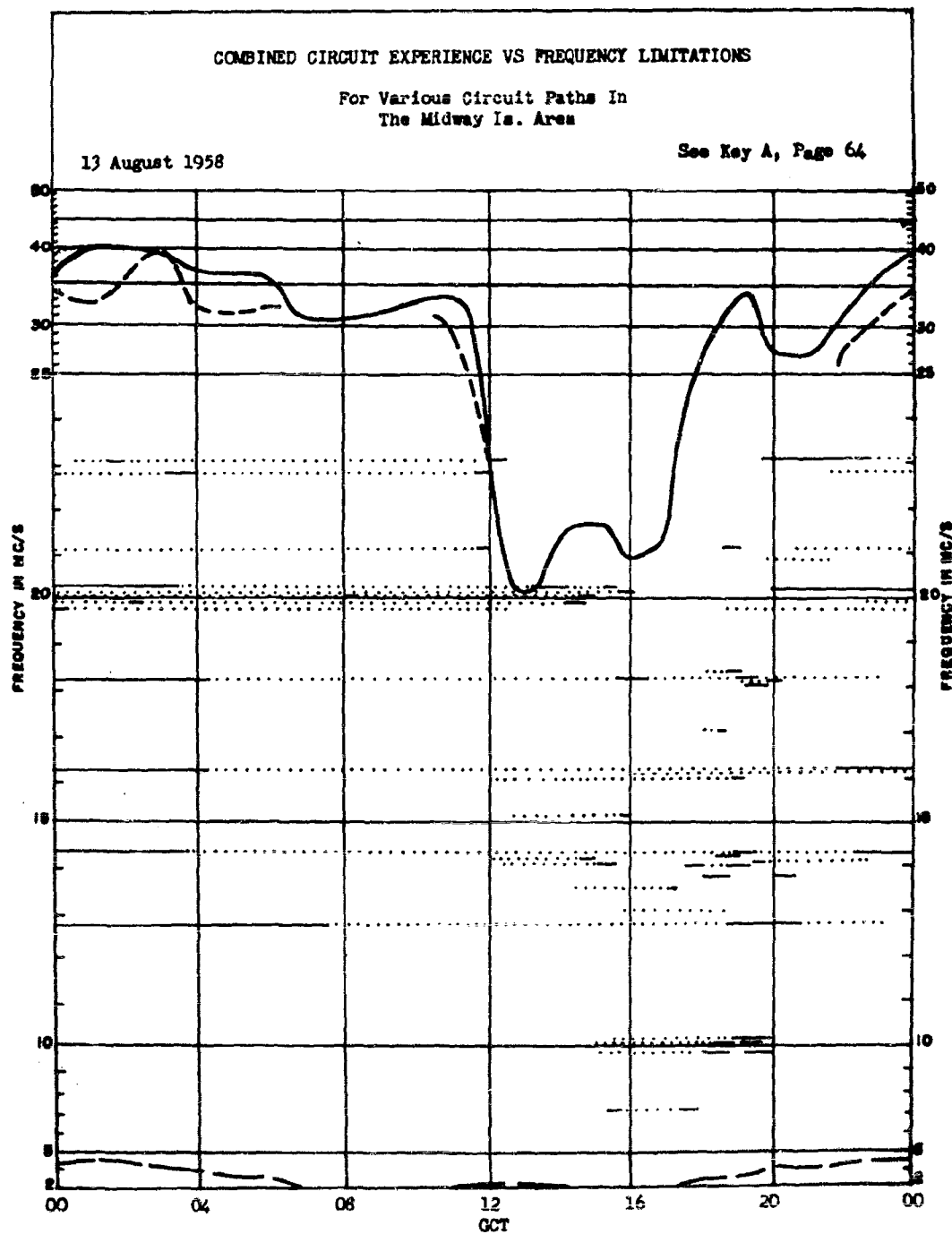


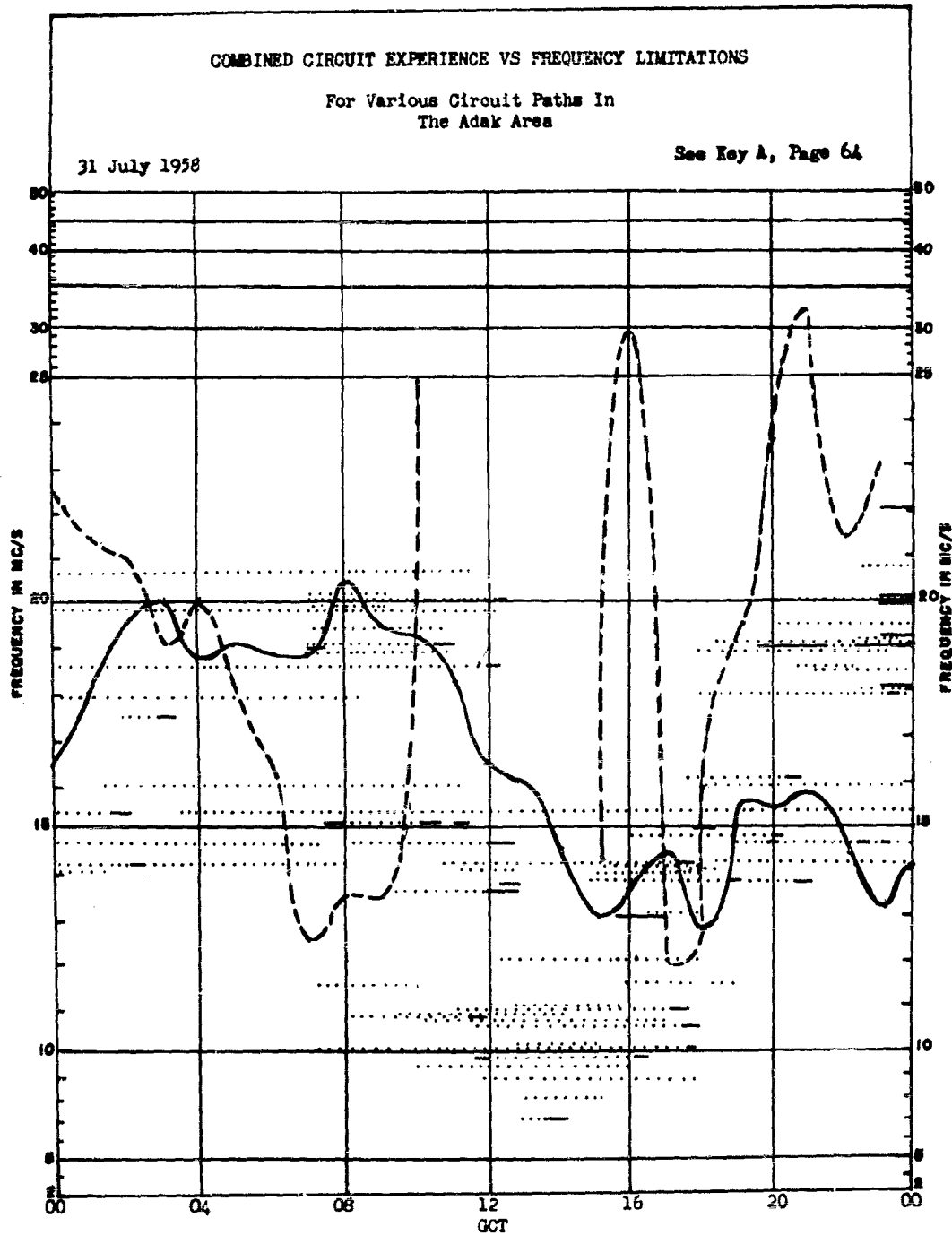
Figure 16

80

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



81

Figure 17

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U. S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

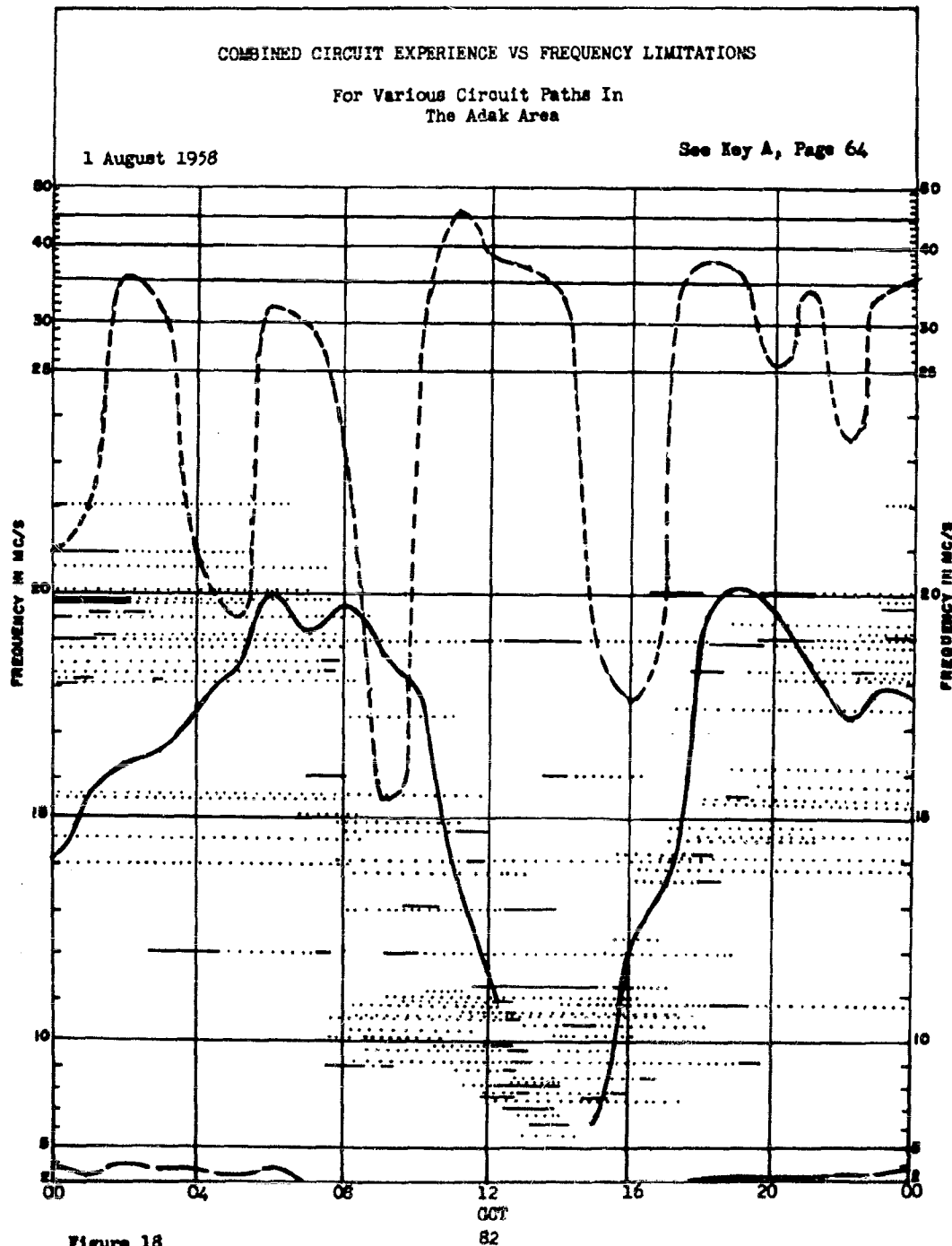


Figure 18

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

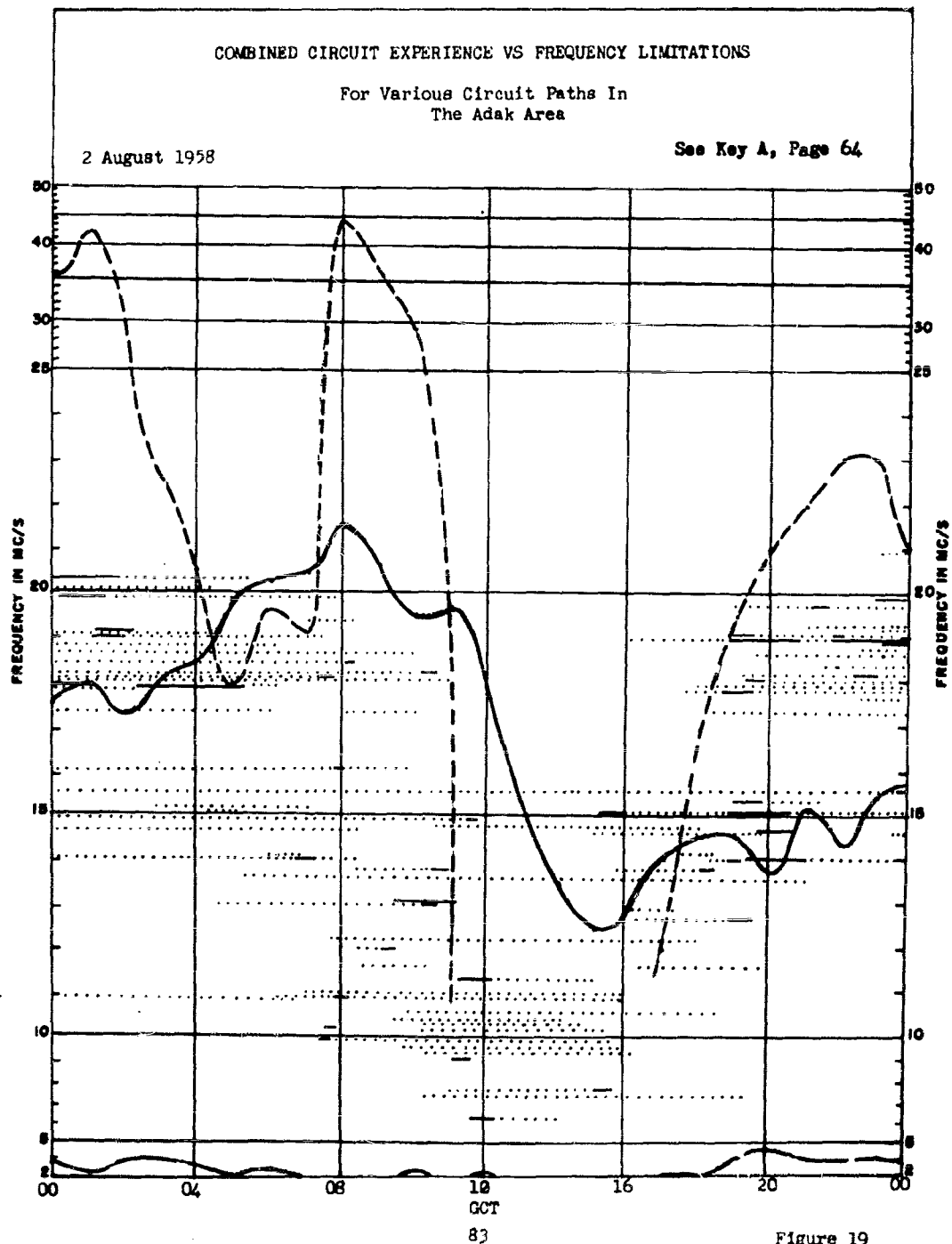
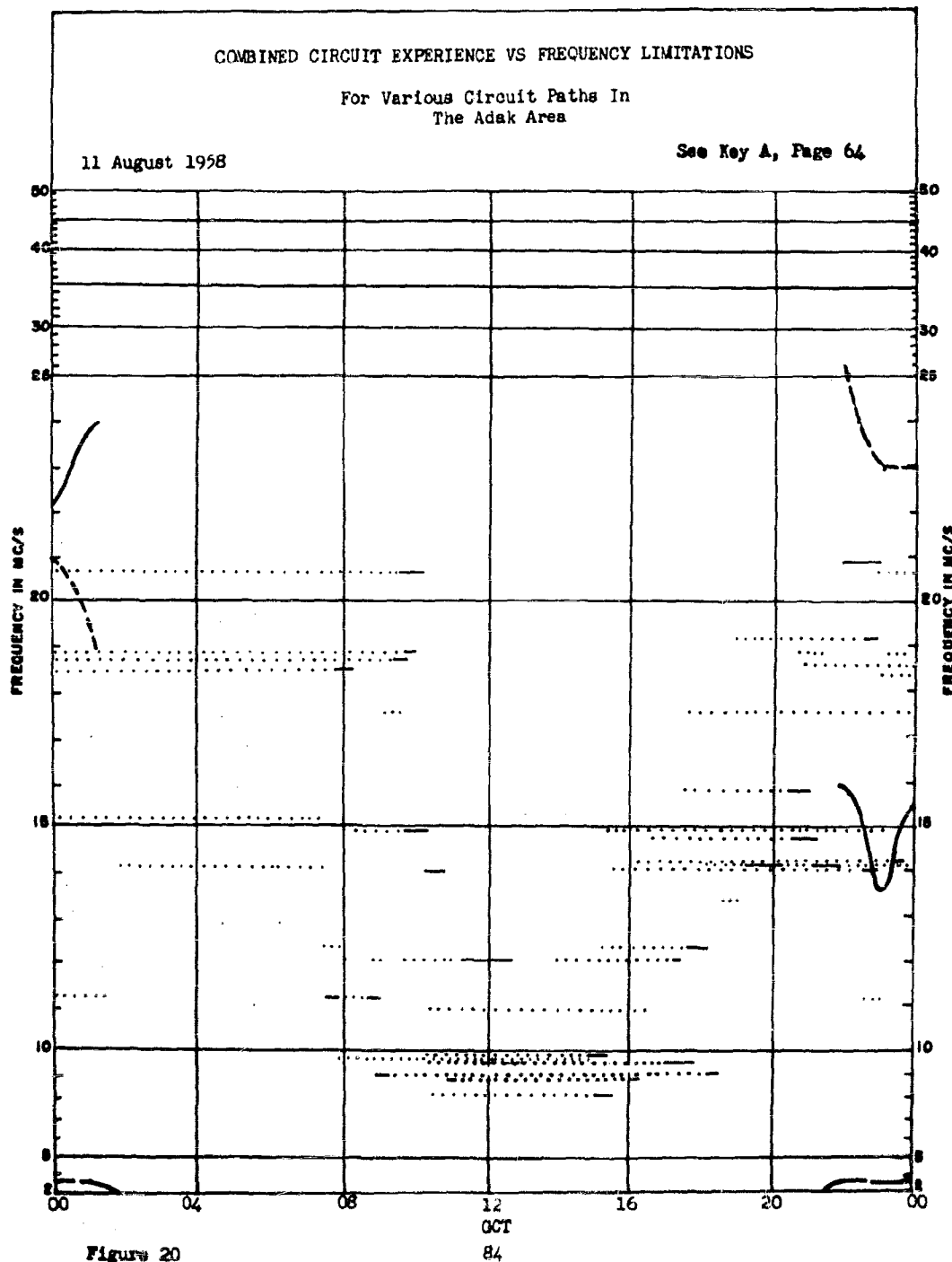


Figure 19

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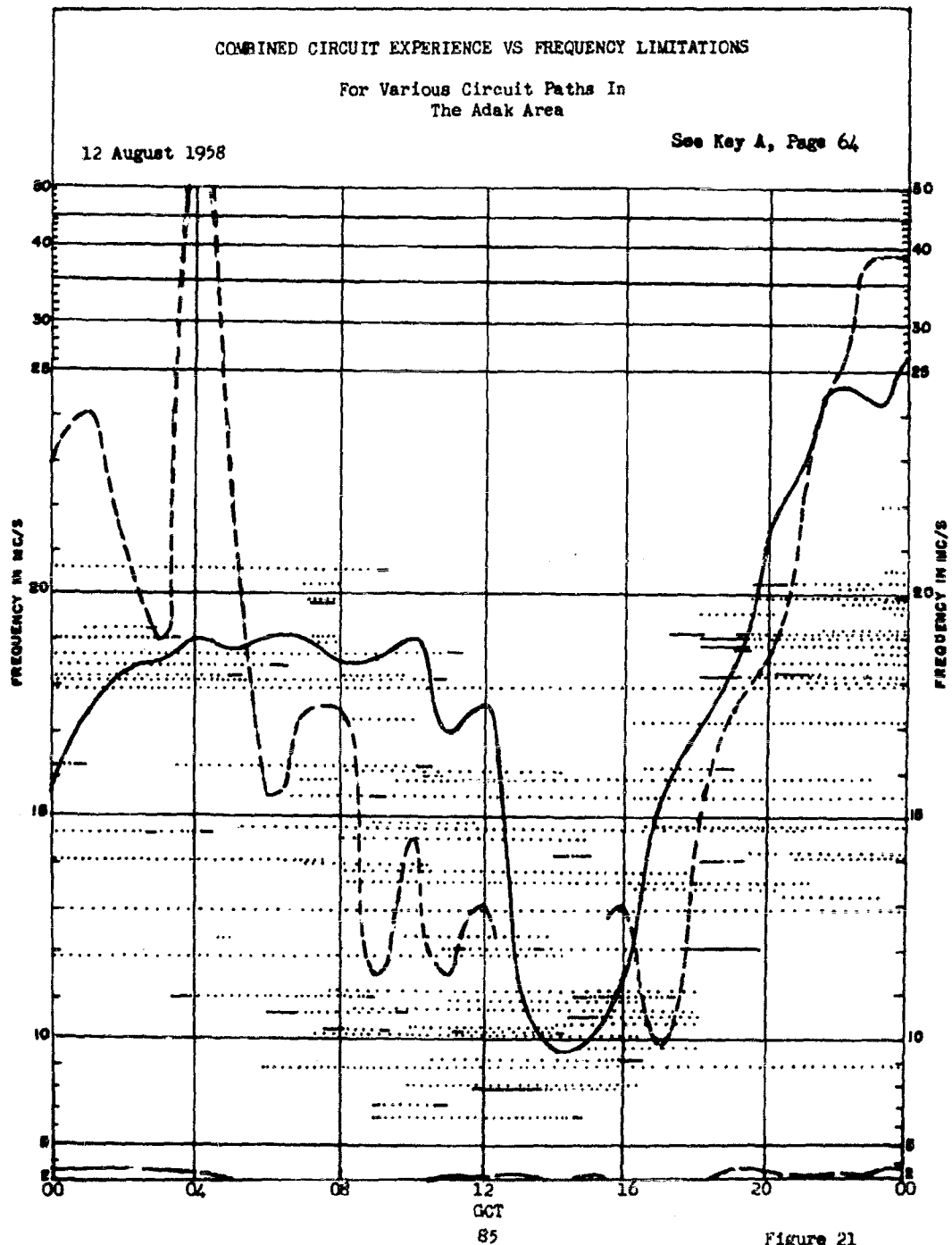
U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

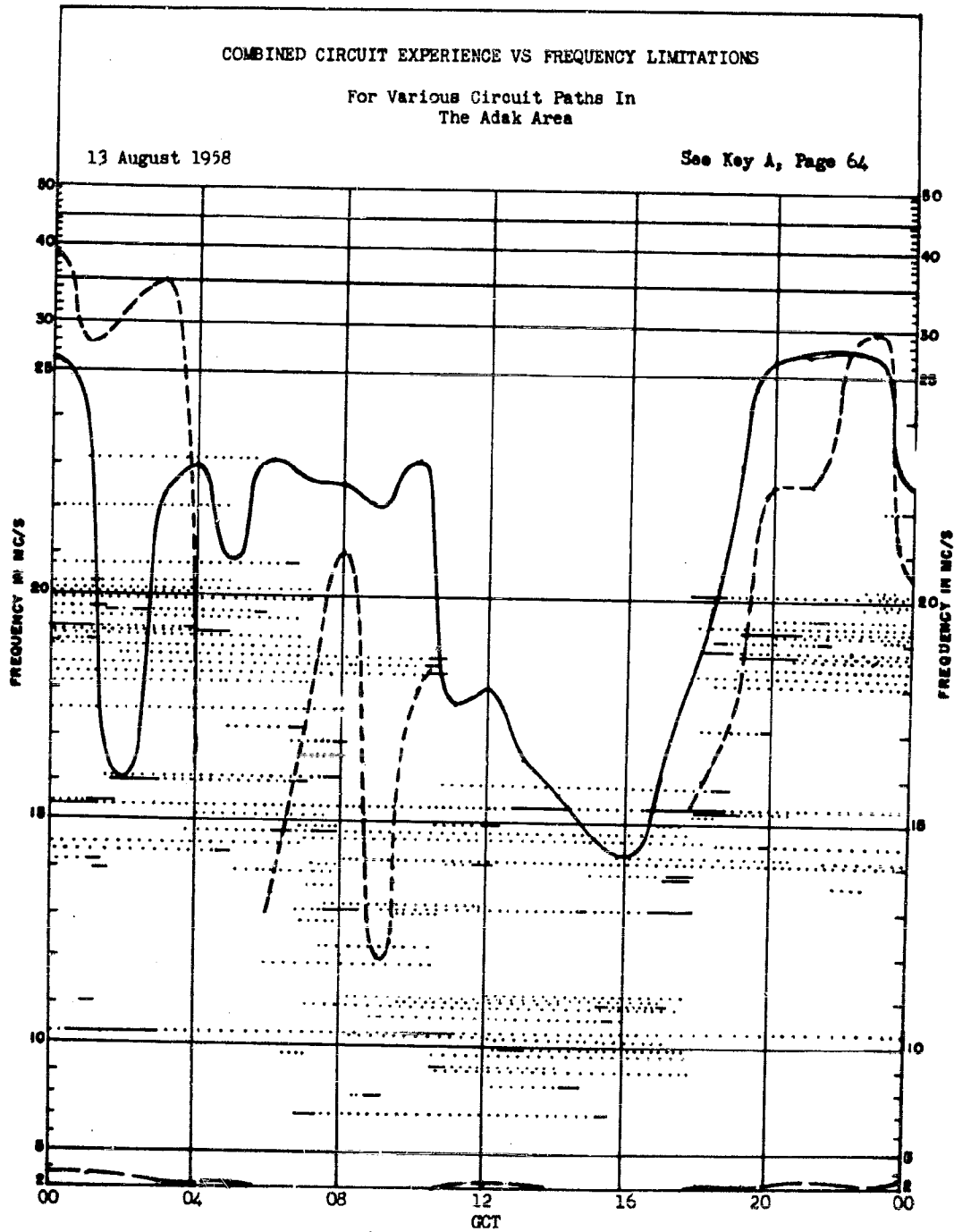
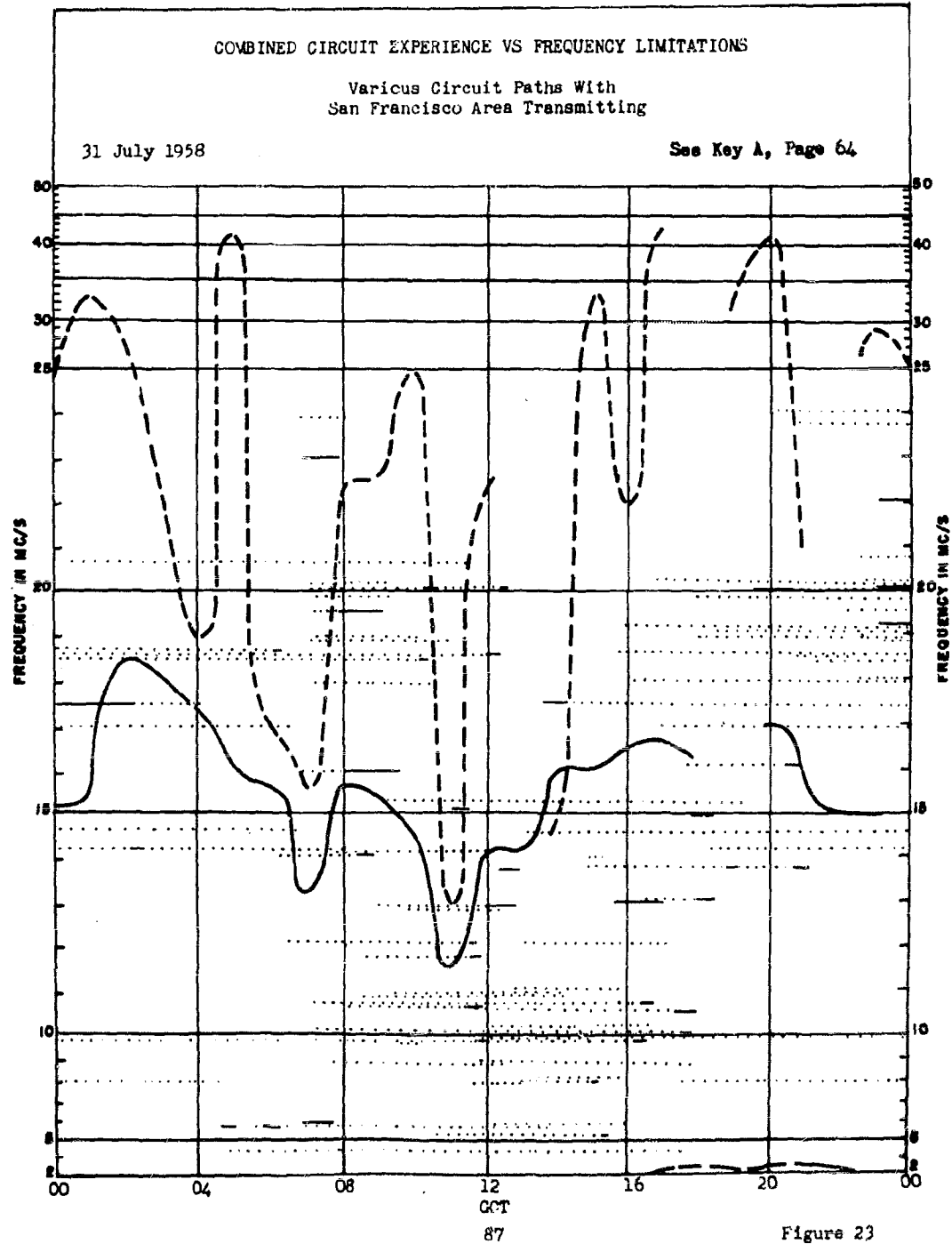


Figure 22

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

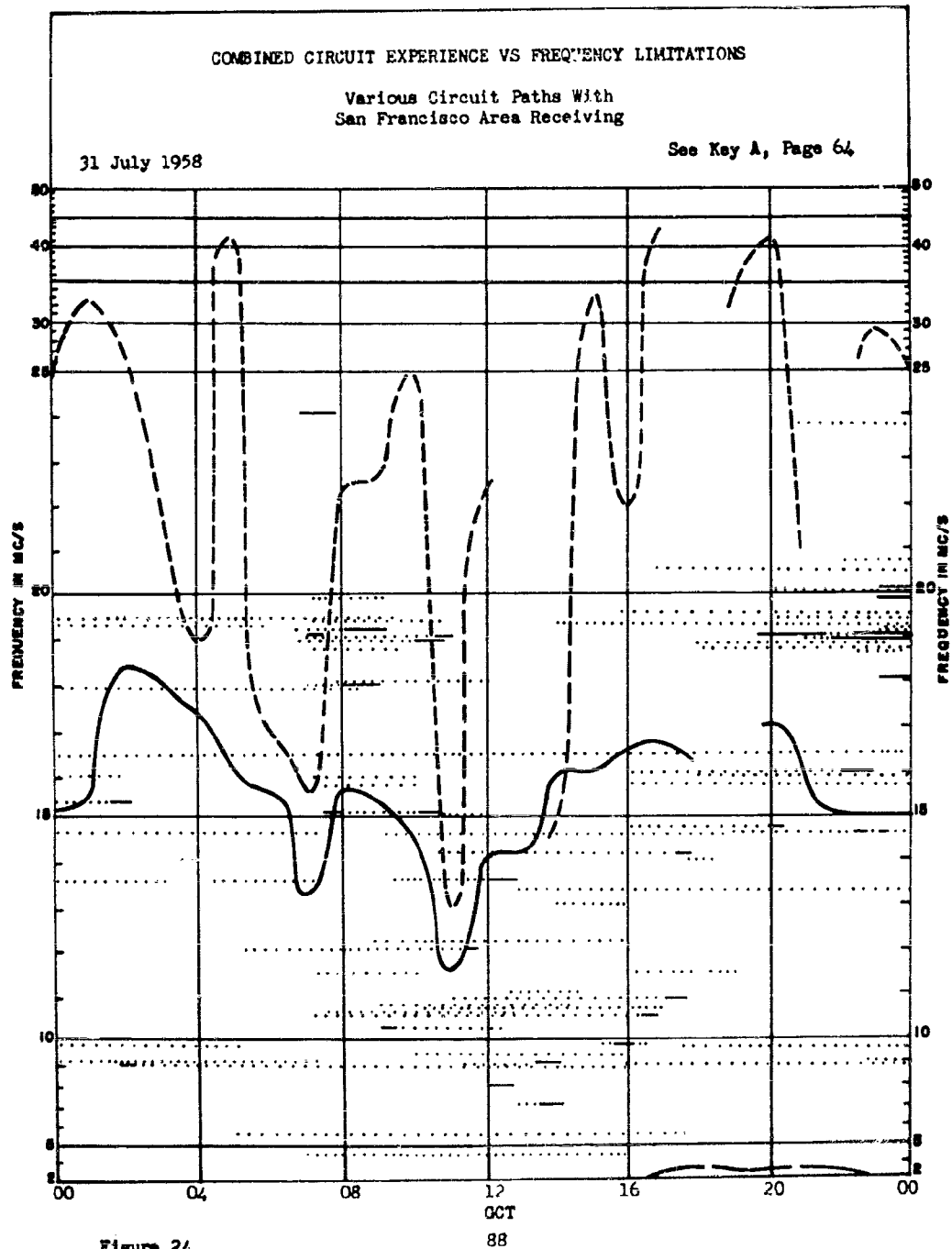
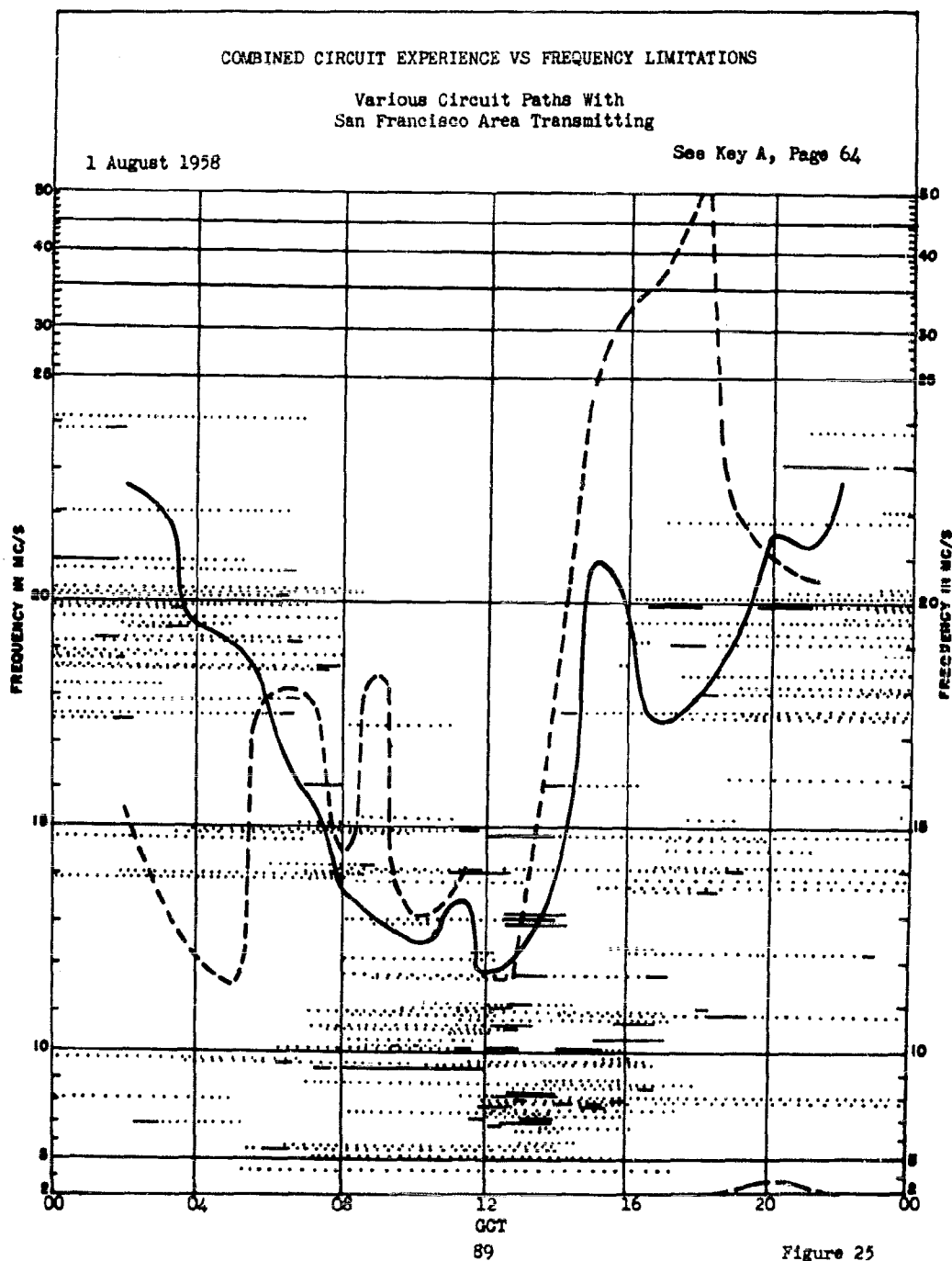


Figure 24

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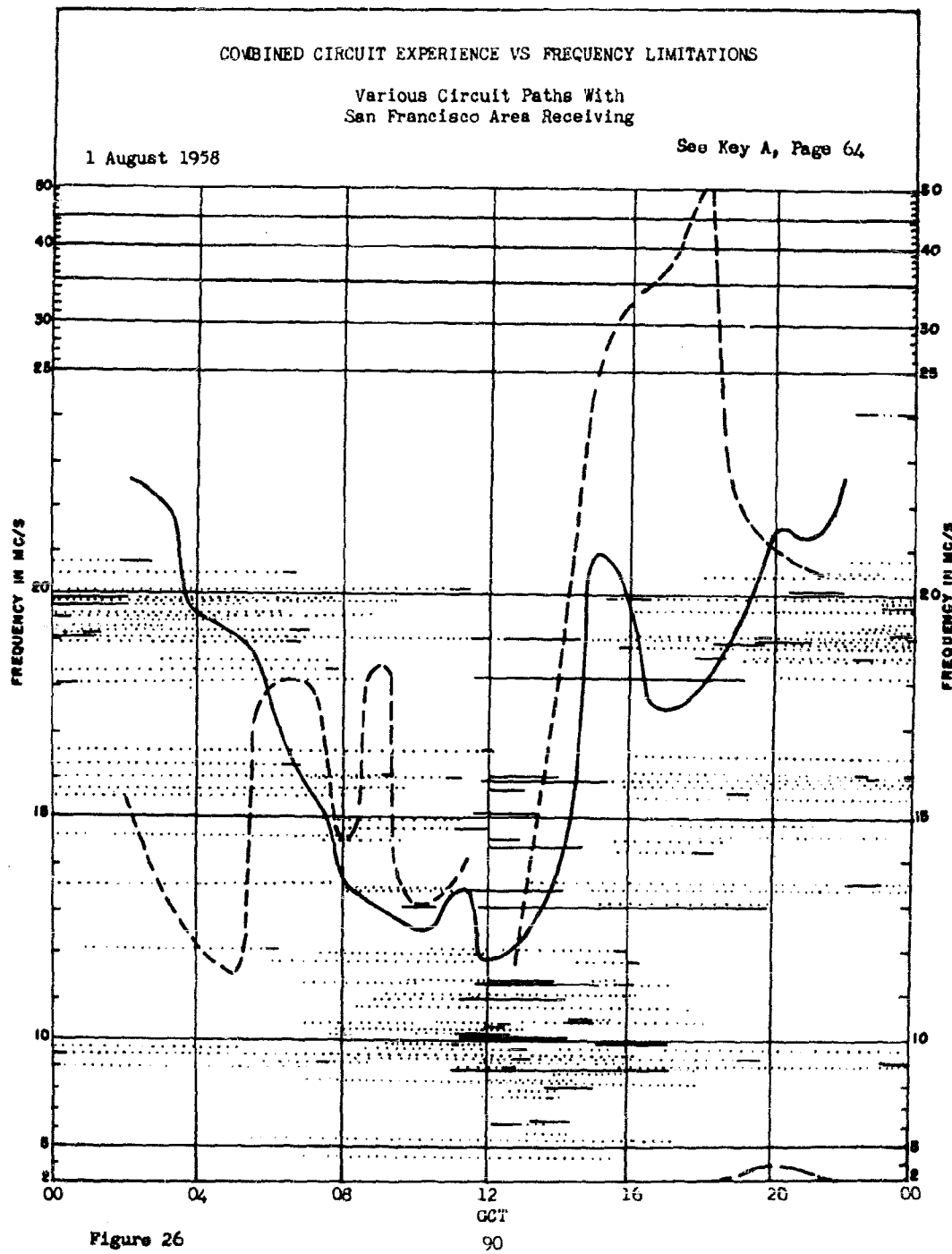
U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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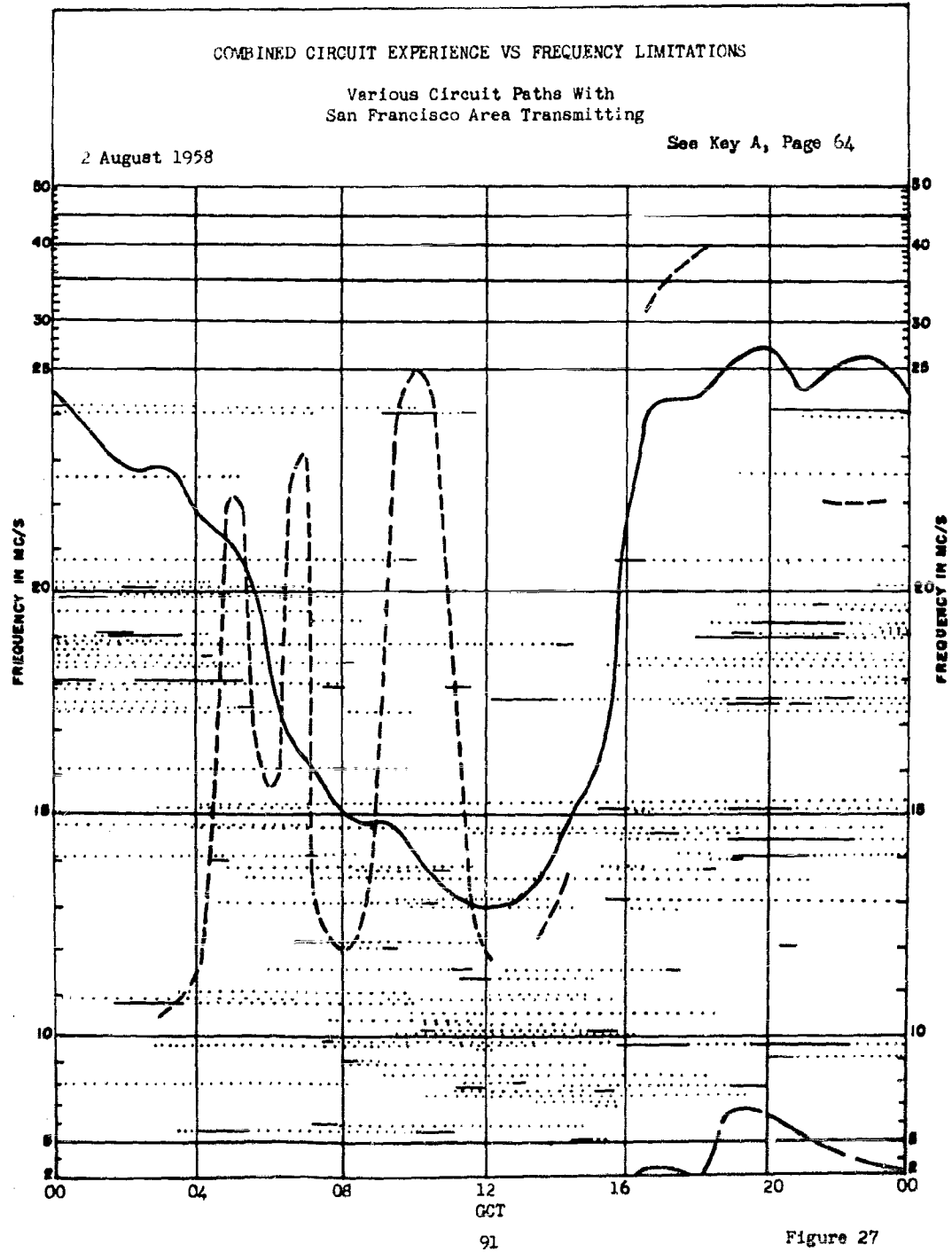
U. S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

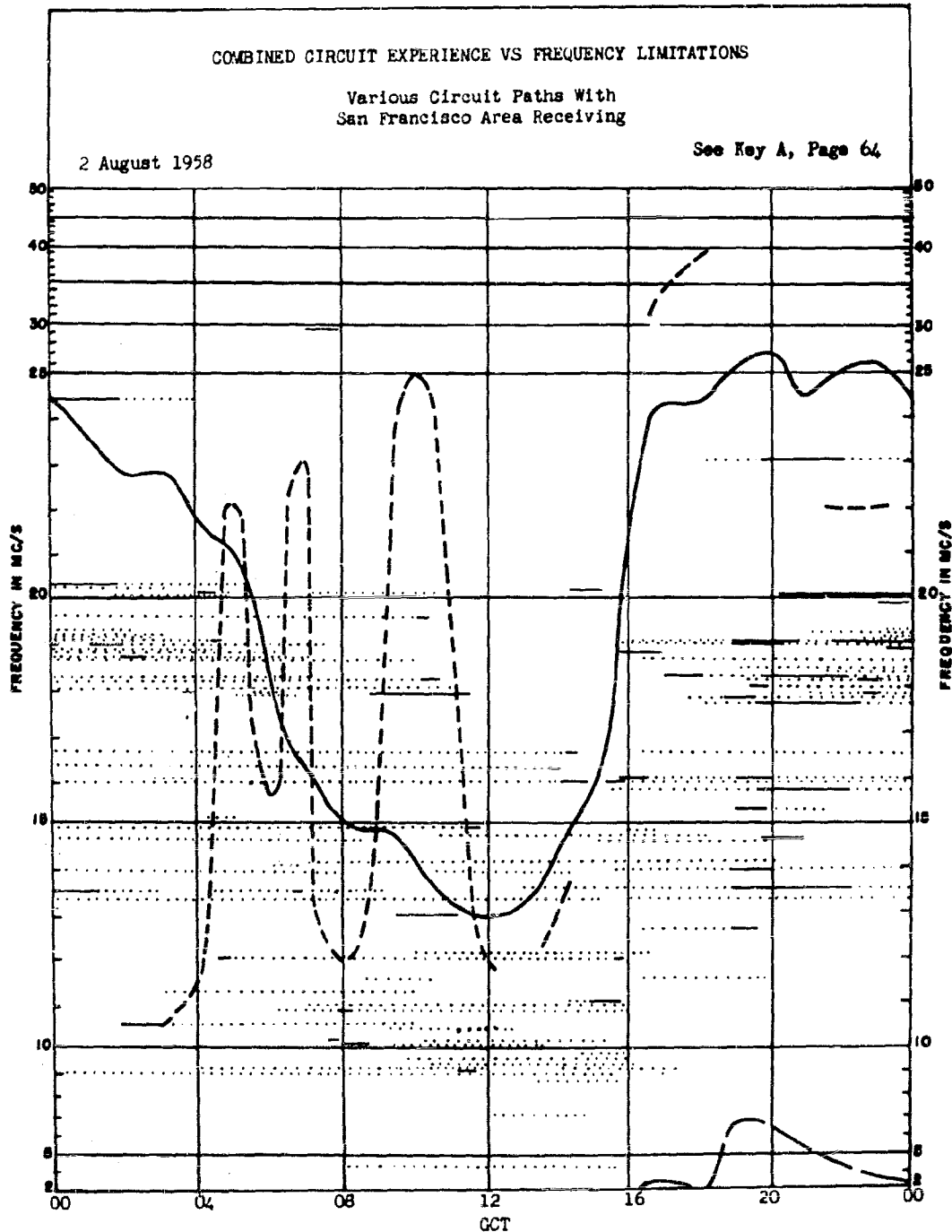


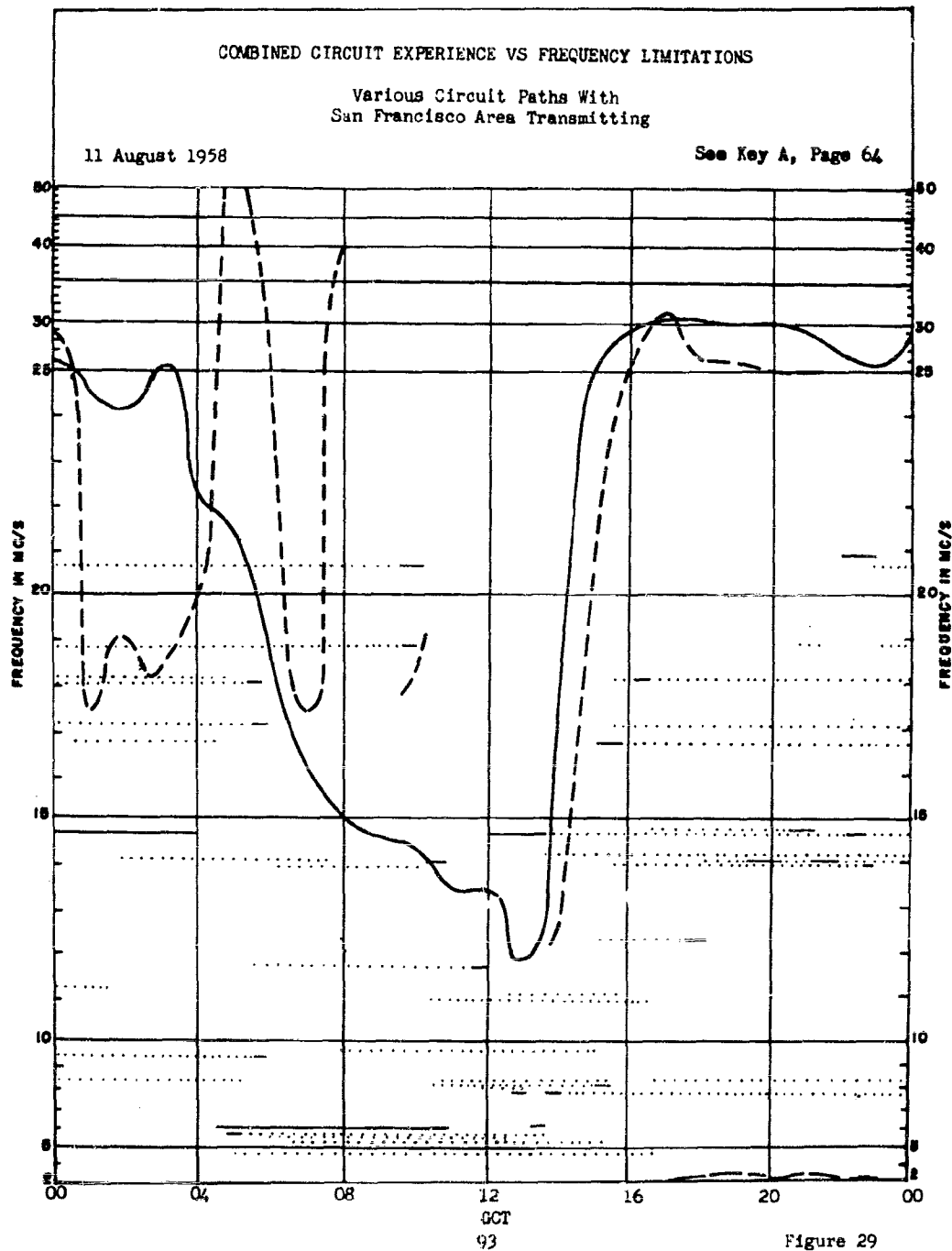
Figure 28

92

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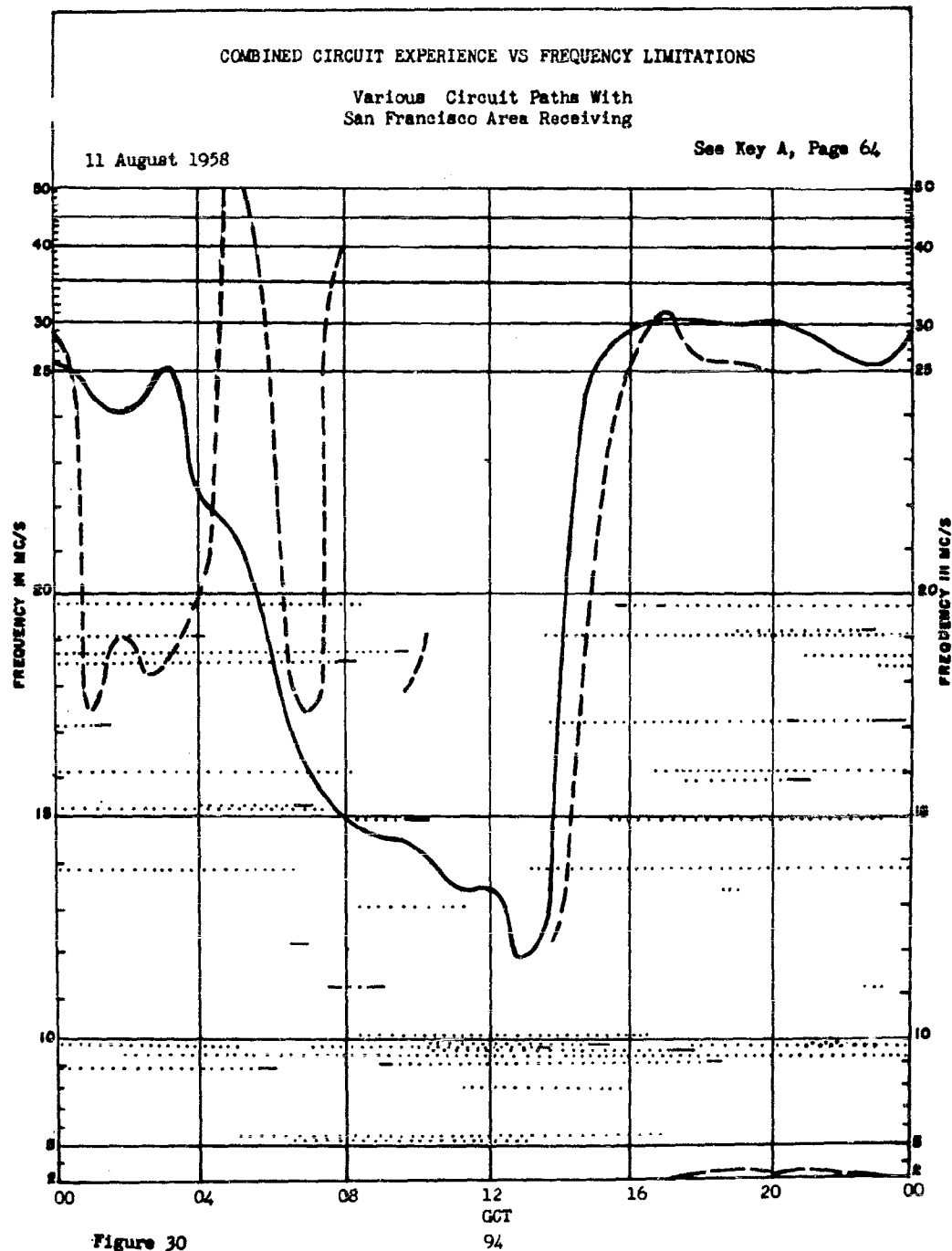
U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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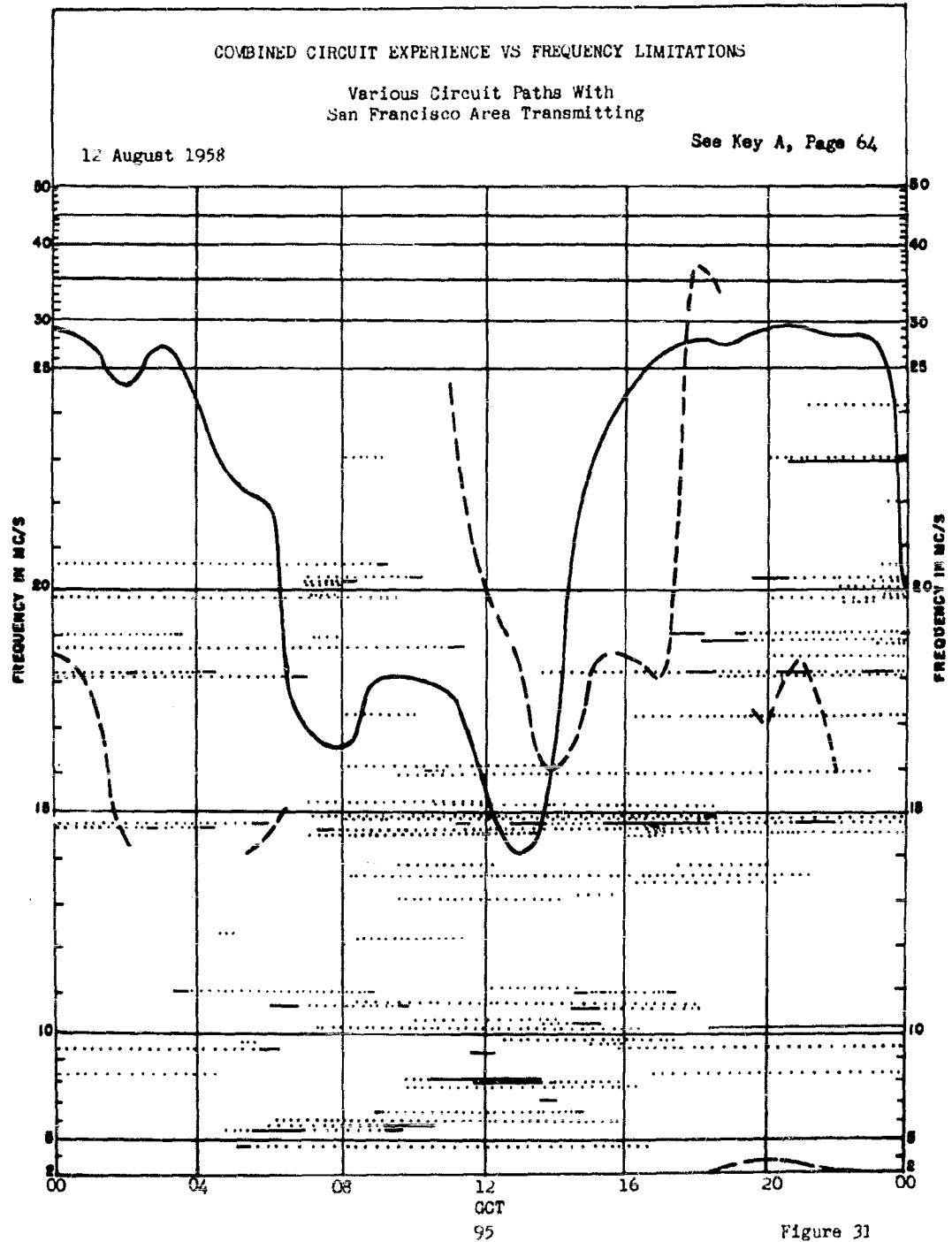
U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

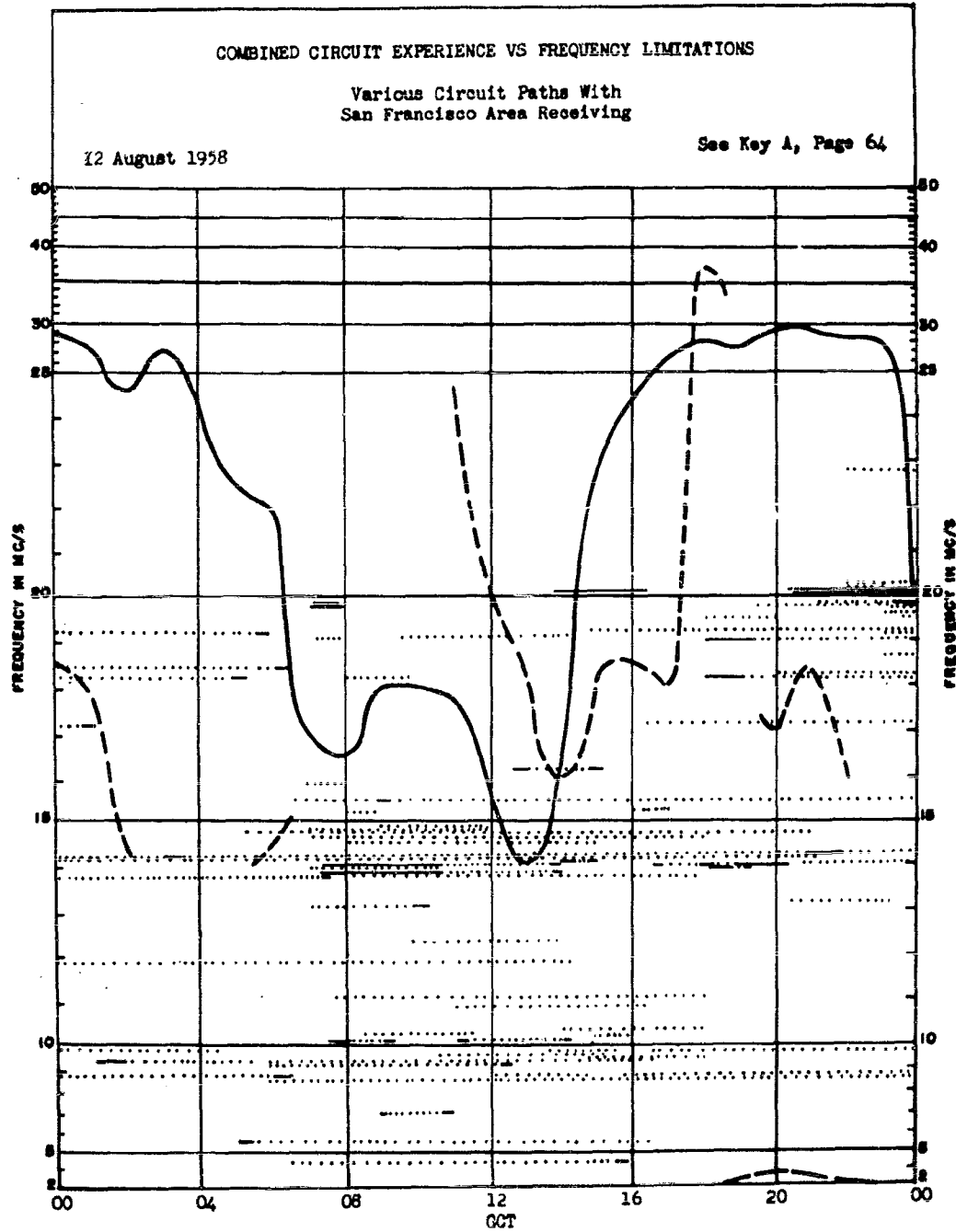


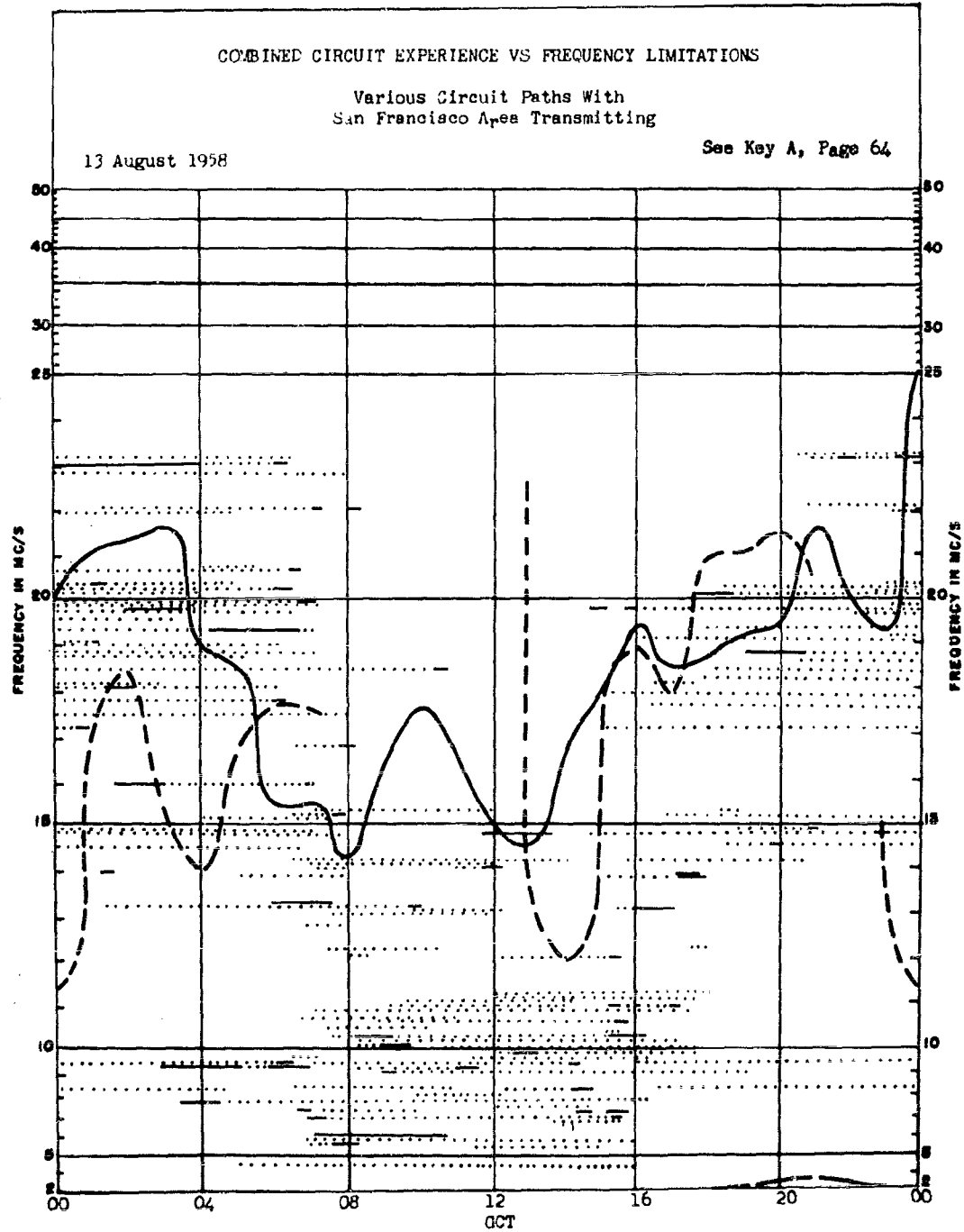
Figure 32

96

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



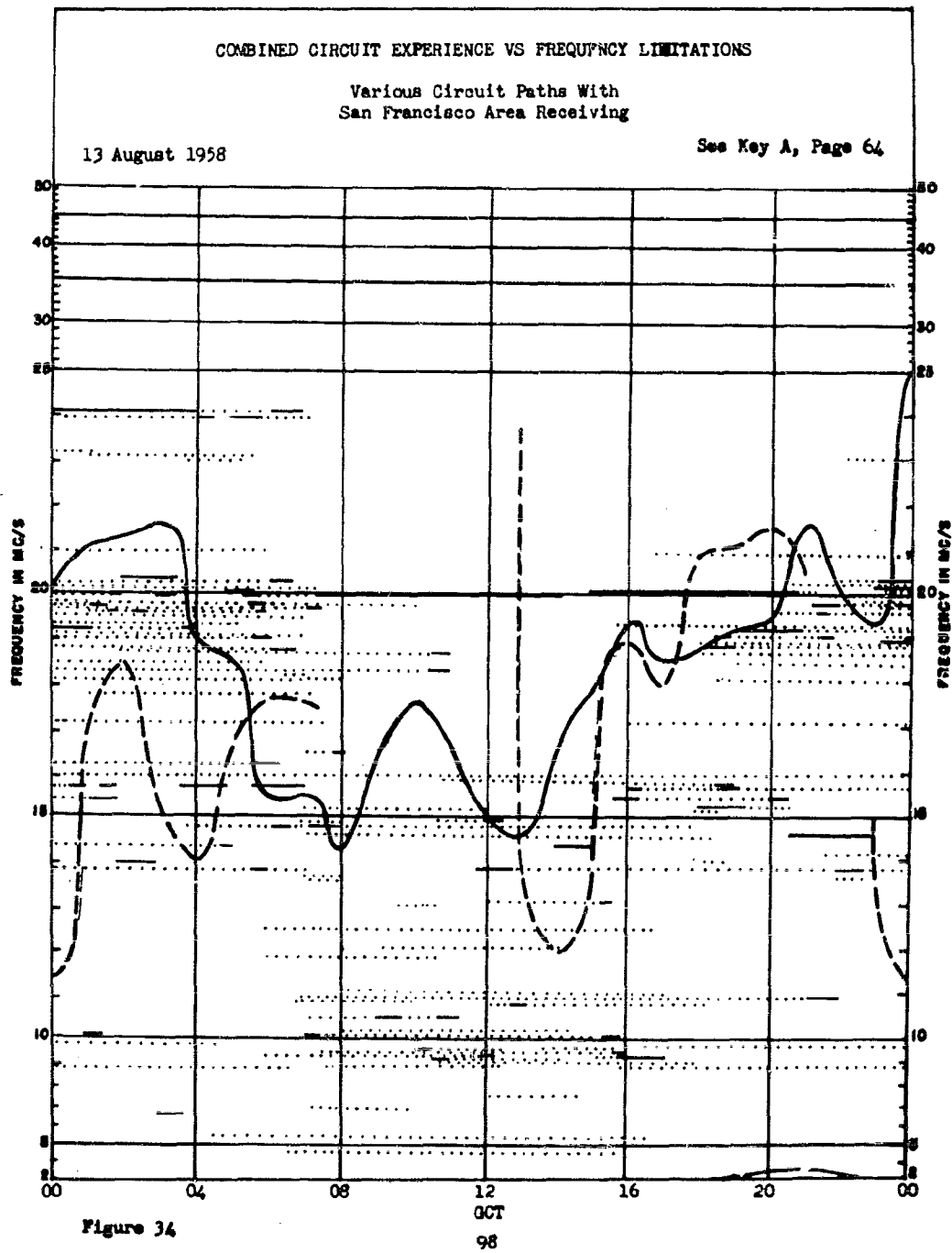
97

Figure 33

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

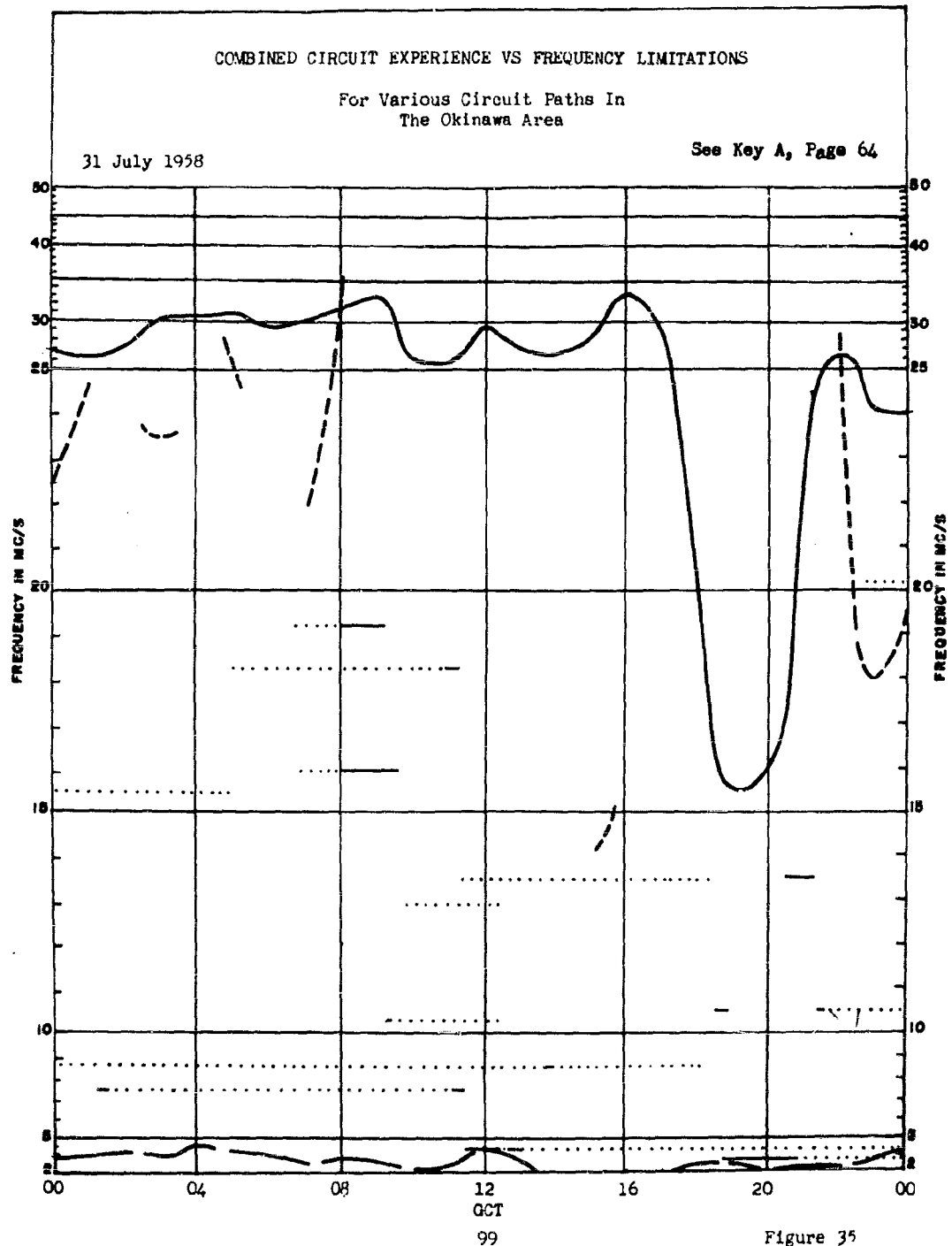


Figure 35

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

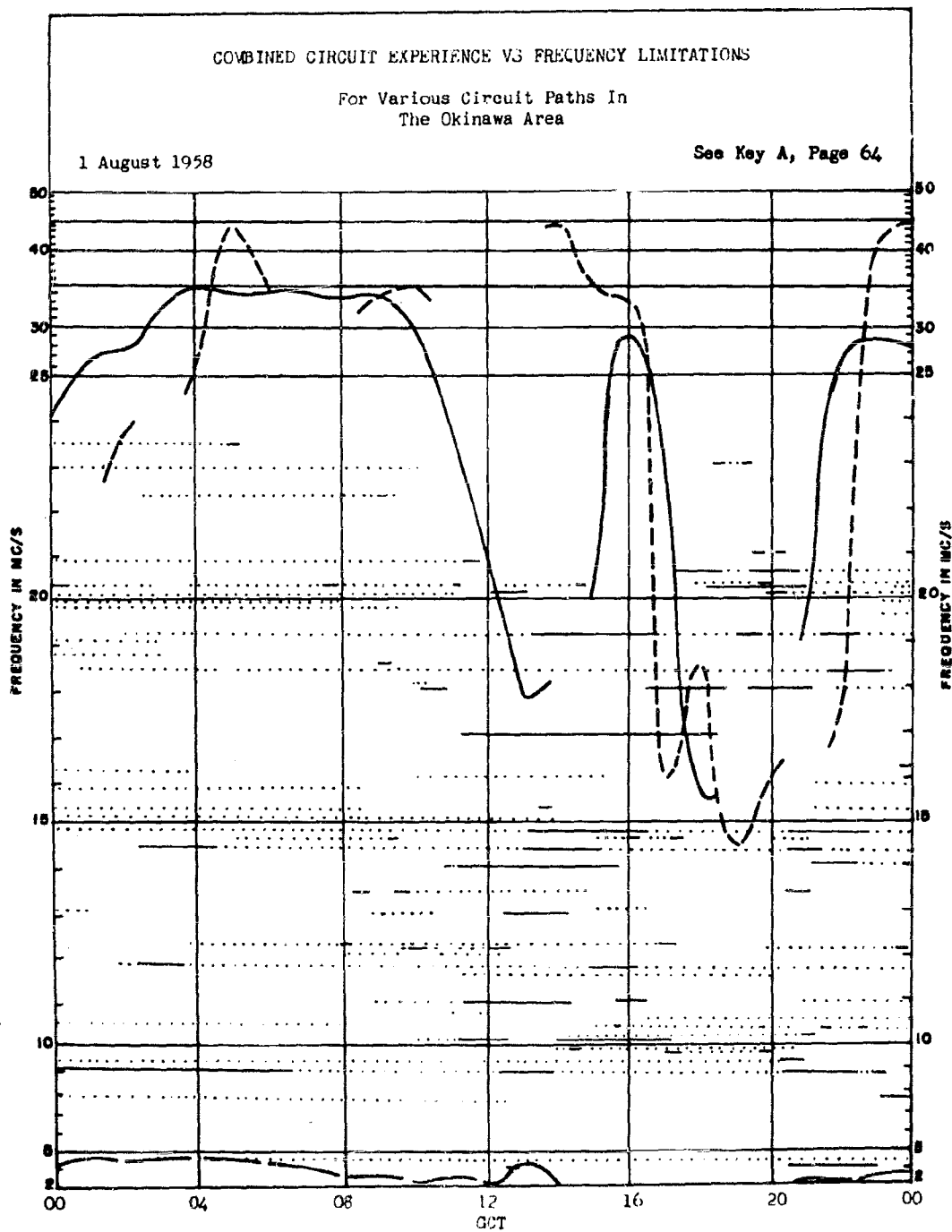


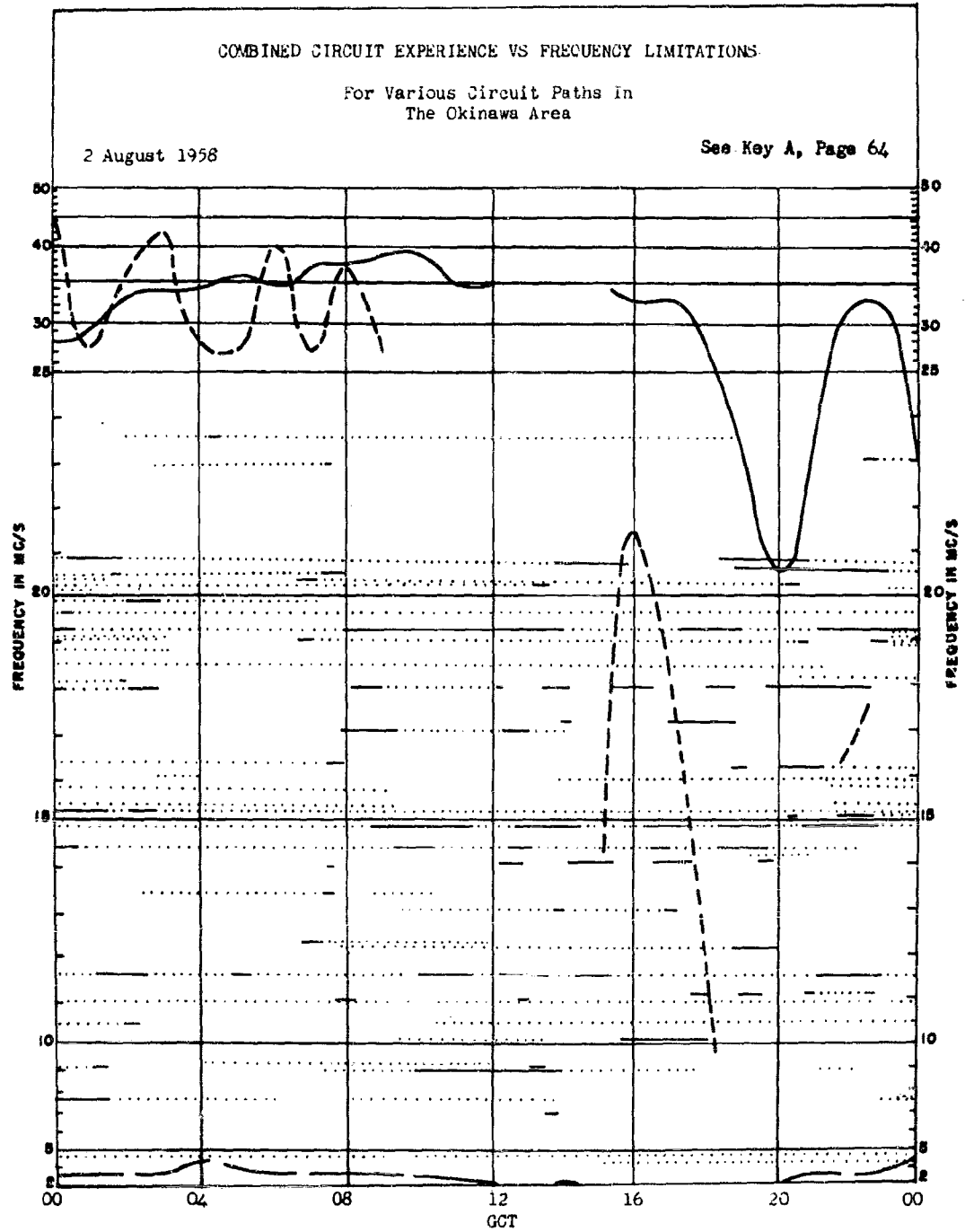
Figure 36

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



101

Figure 37

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

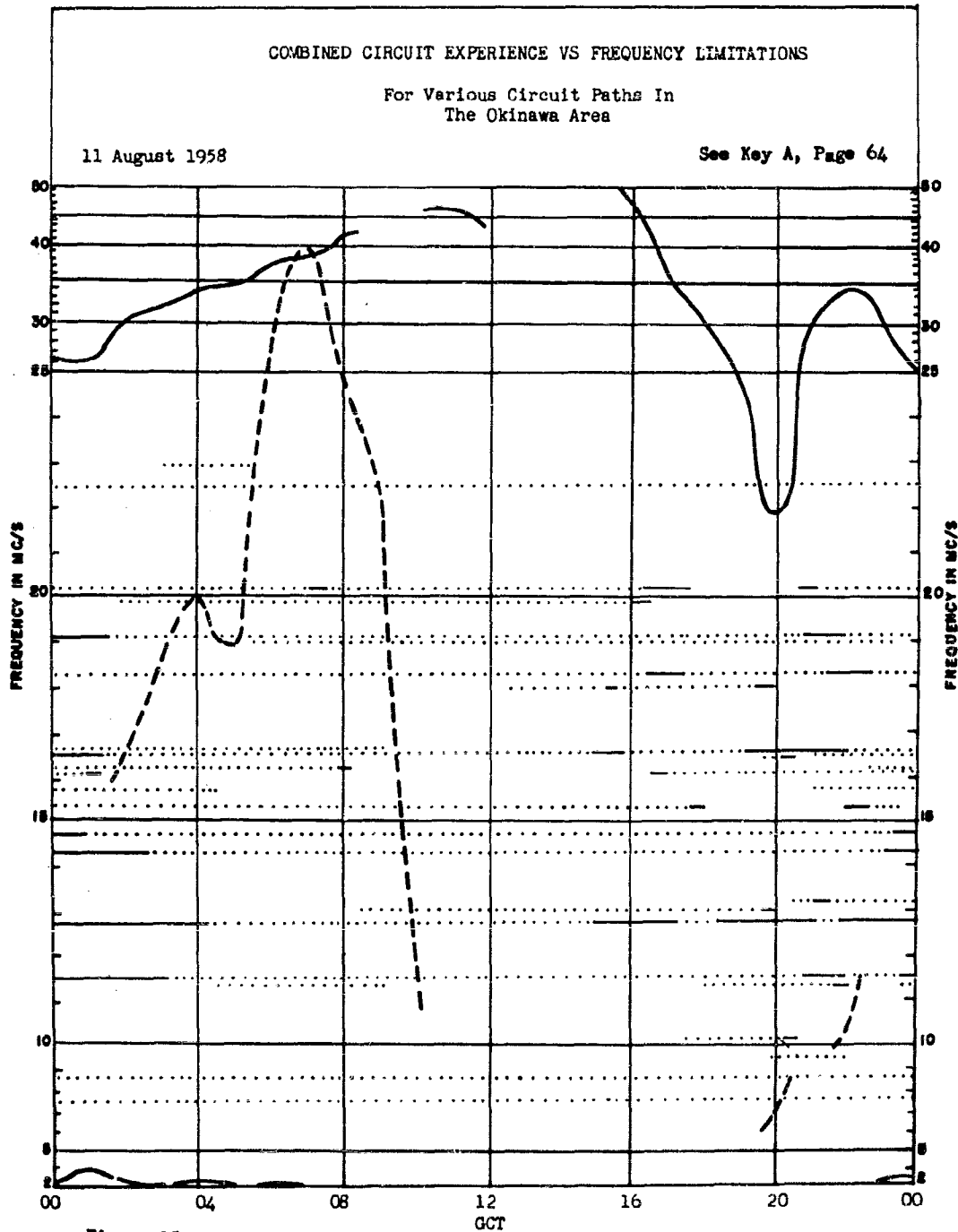


Figure 38

102

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

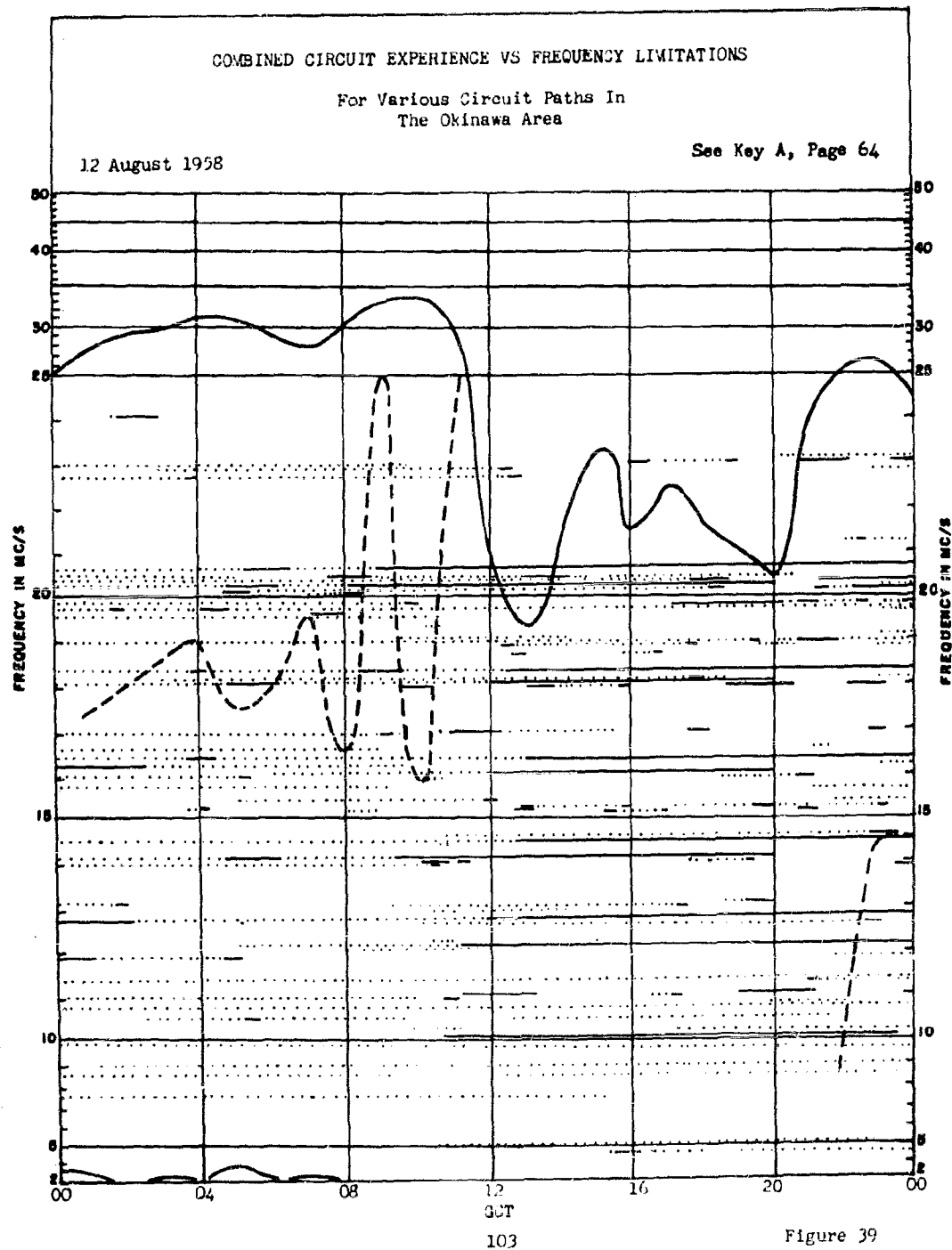
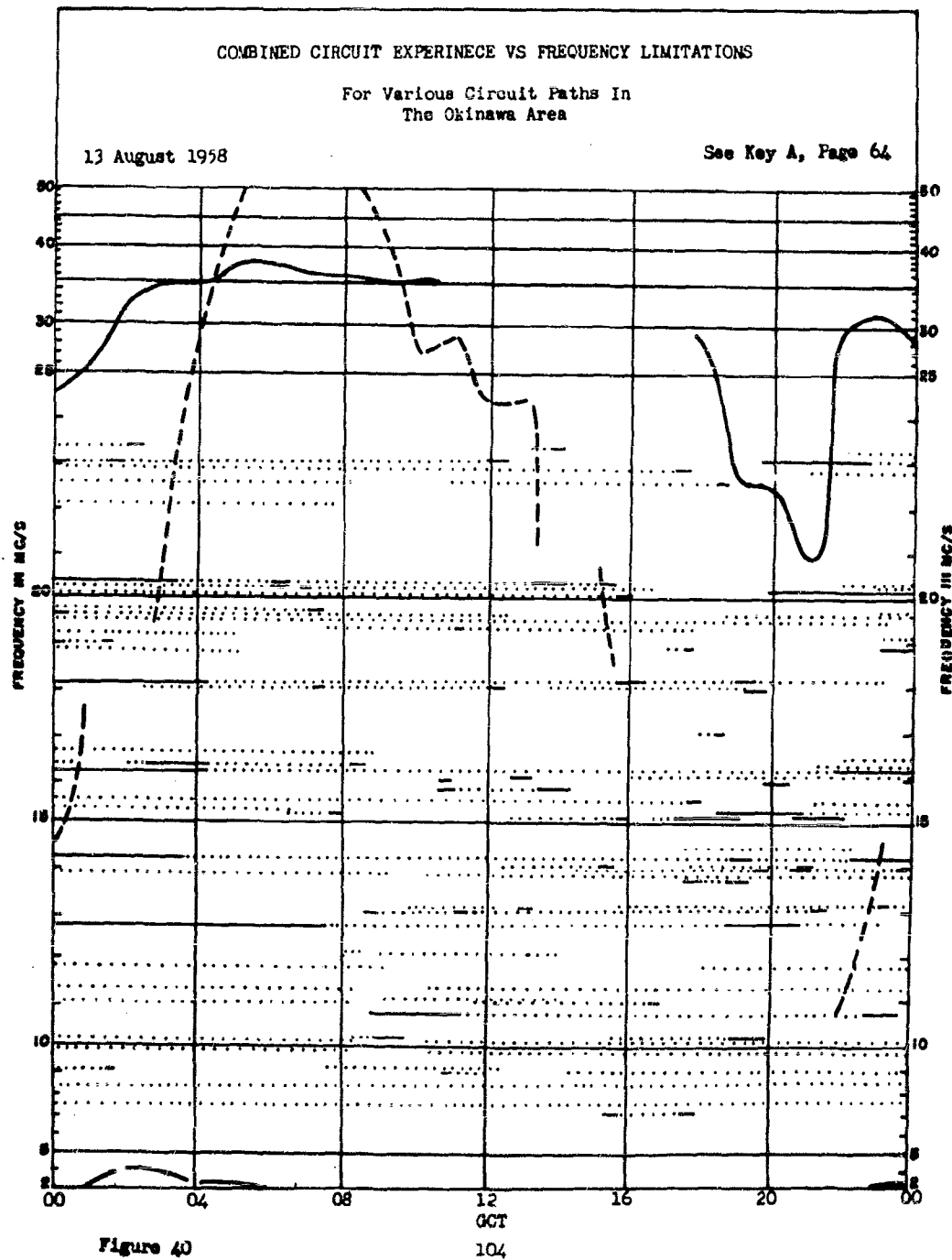


Figure 39

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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SYNOPTIC MAPS OF REPORTED CIRCUIT EXPERIENCE

DURING TIME INTERVAL OF ONE HOUR ALONG

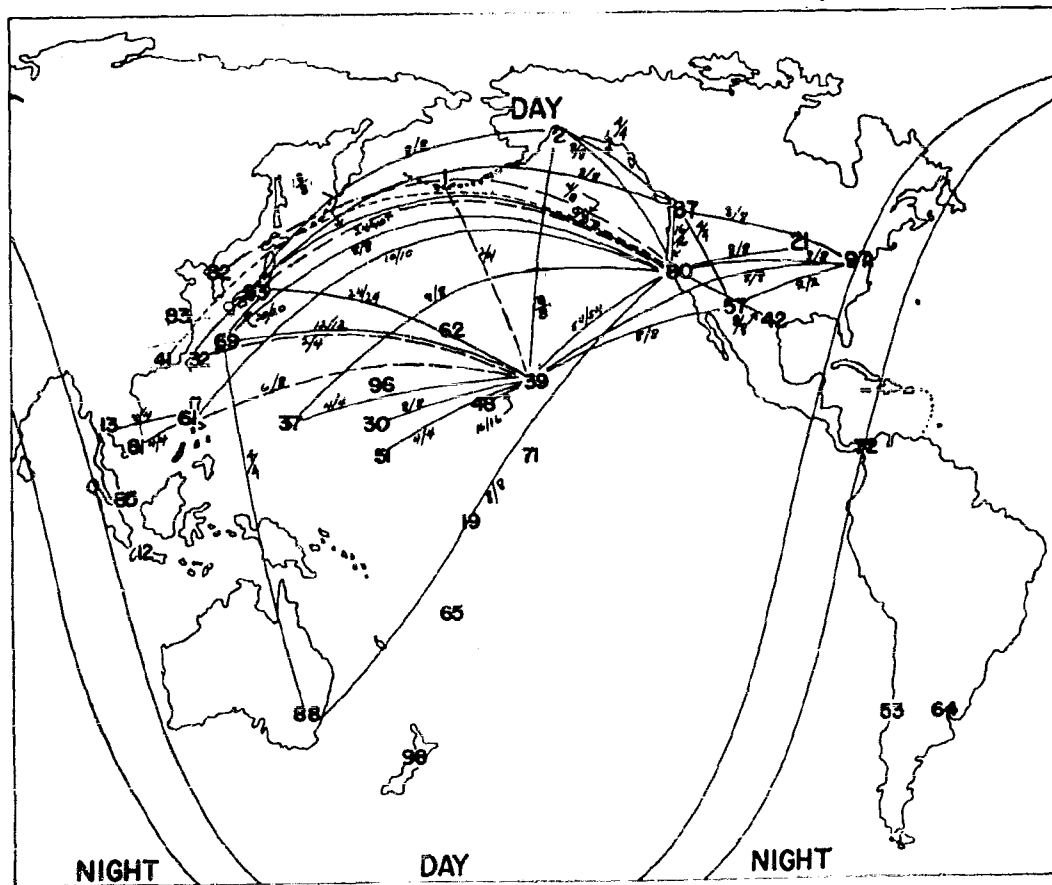
SELECTED GLOBAL COMMUNICATION PATHS

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: **0000Z**

**1 AUGUST 1958**



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANCE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

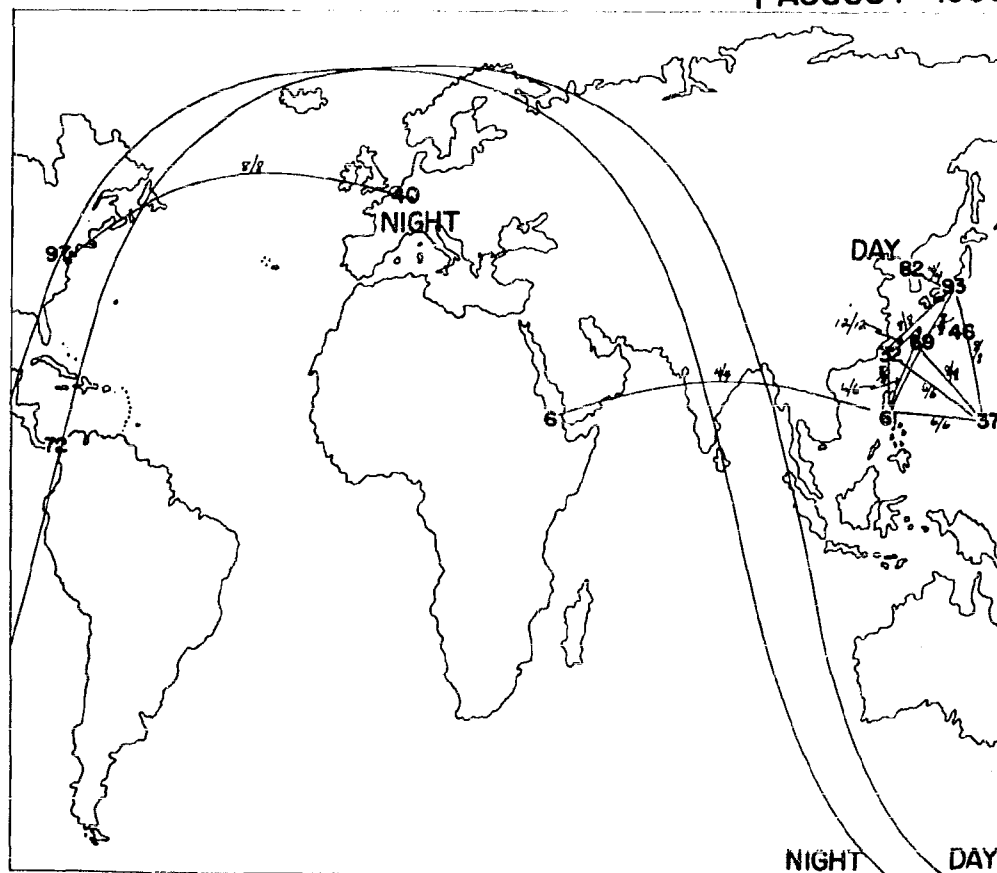
**SECRET**

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 0000 Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: - - - - -
- 80% to 100% of frequencies tried were useful: - - - - -

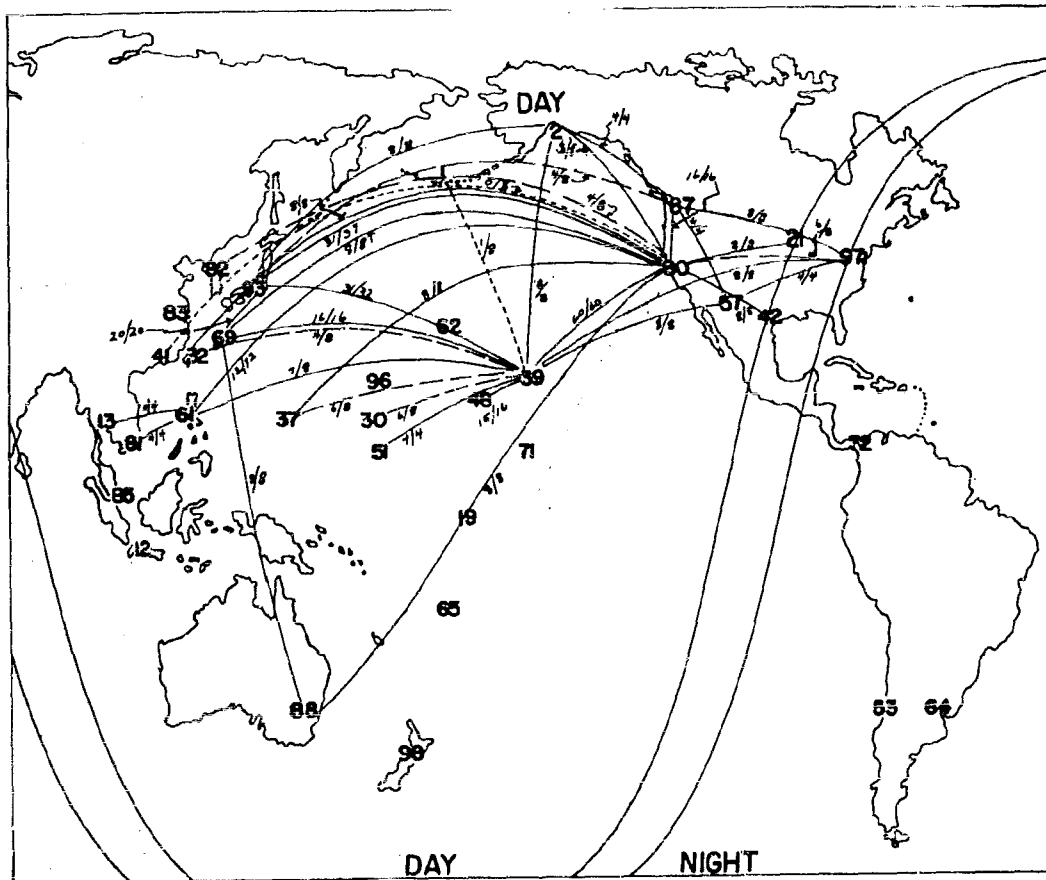
( ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0100Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BAMDUND	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SECUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	67. OKINAWA	83. SHANGHAI

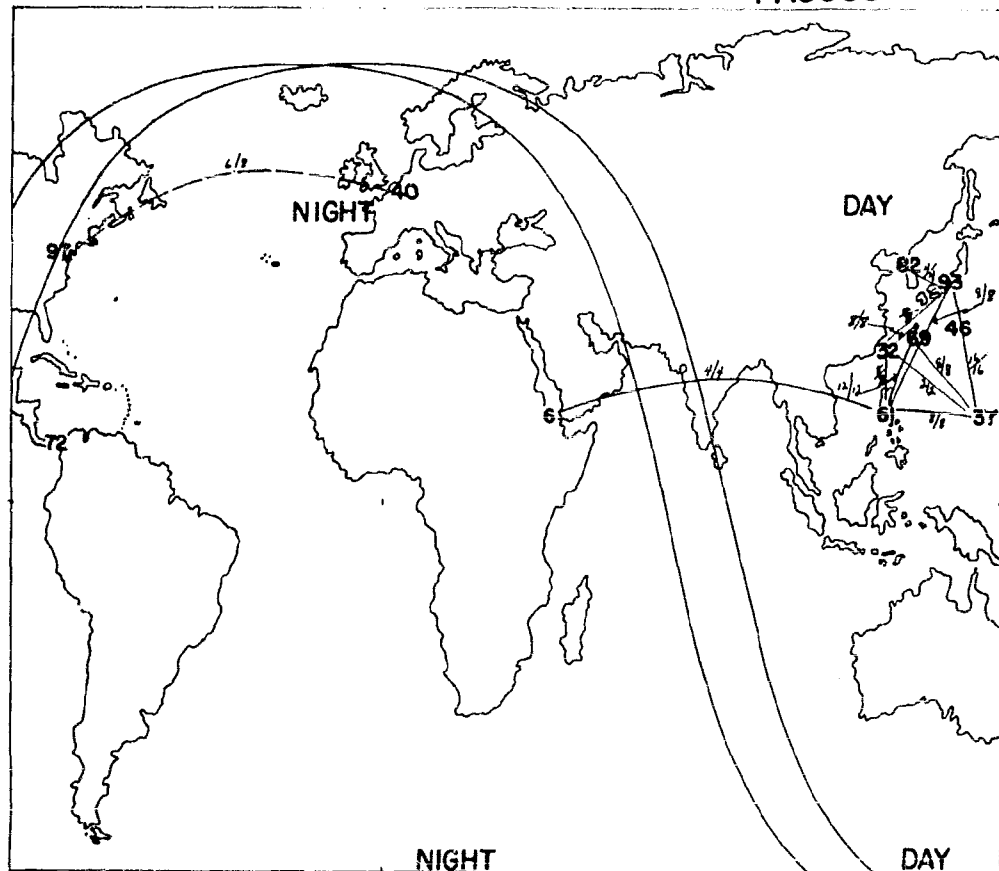
**SECRET**

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 0100 Z

1 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

### KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

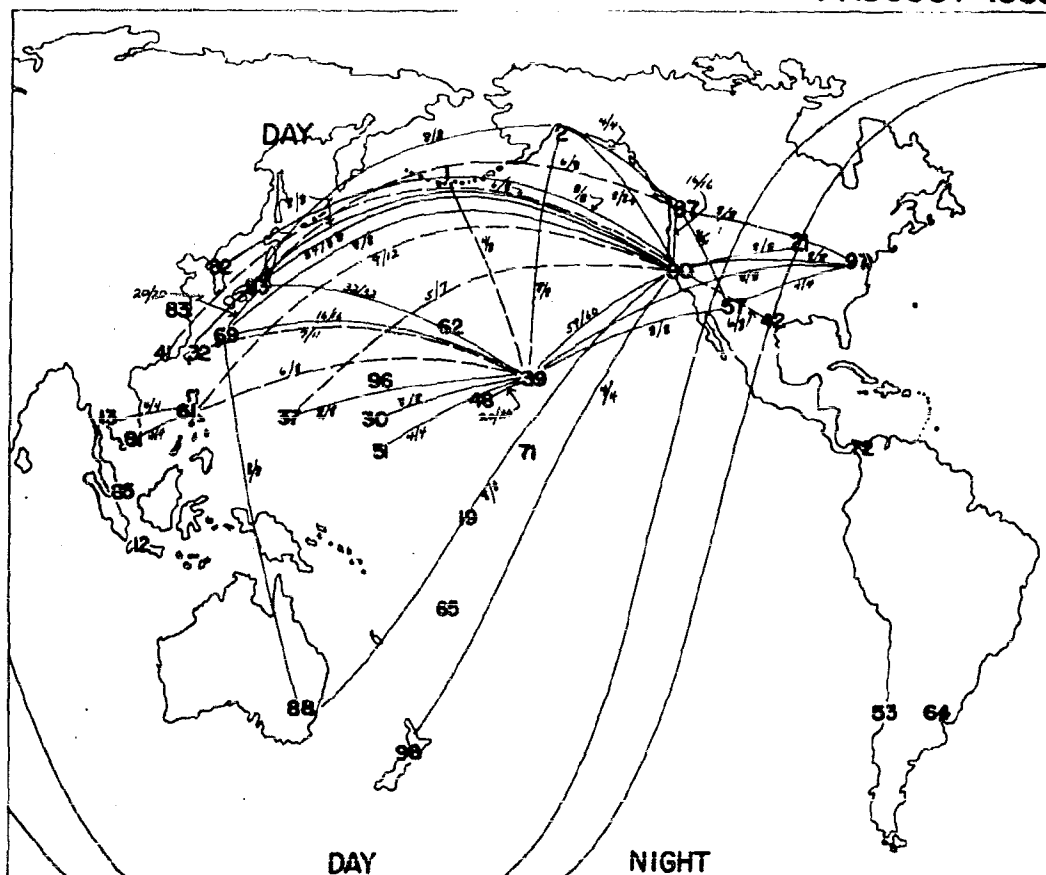
( $\frac{\text{X}}{\text{Y}}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

# SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0200Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONOLULU	57. LOS ANGELES	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANGKOK	37. OTUM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEINELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

Figure 43a

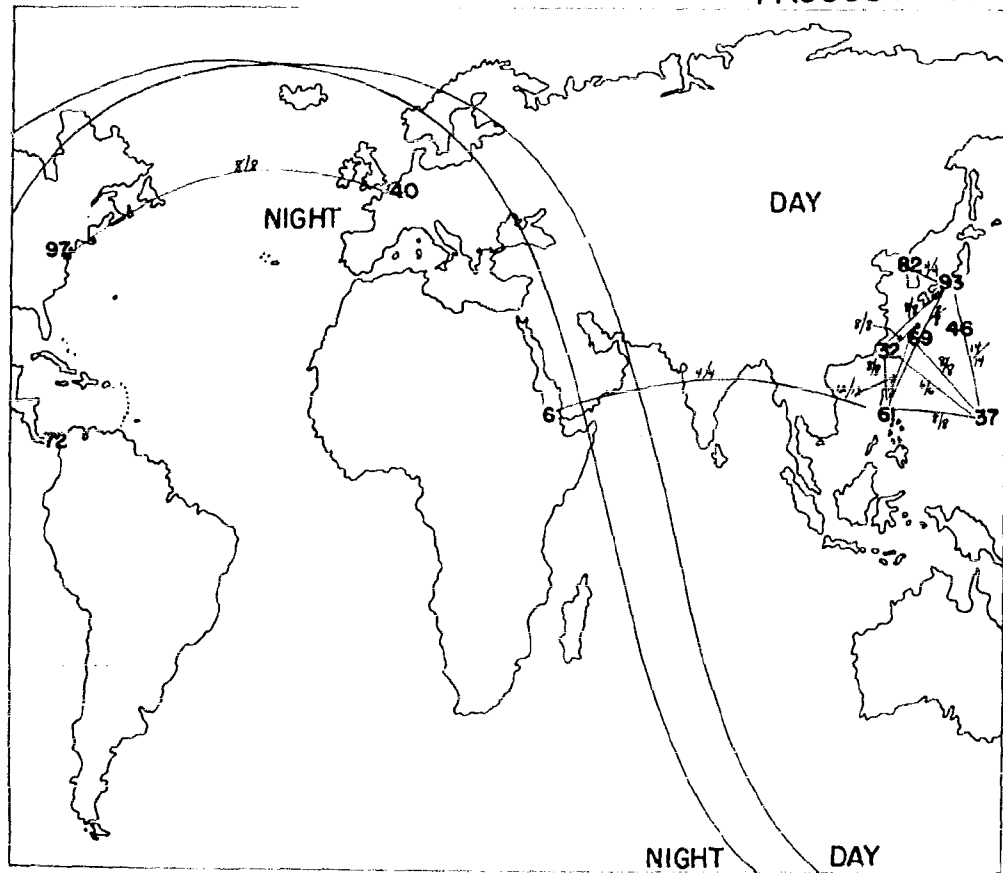
**SECRET**

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 0200 Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS:

- |               |                      |
|---------------|----------------------|
| 83. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

KEY TO FREQUENCY UTILITY

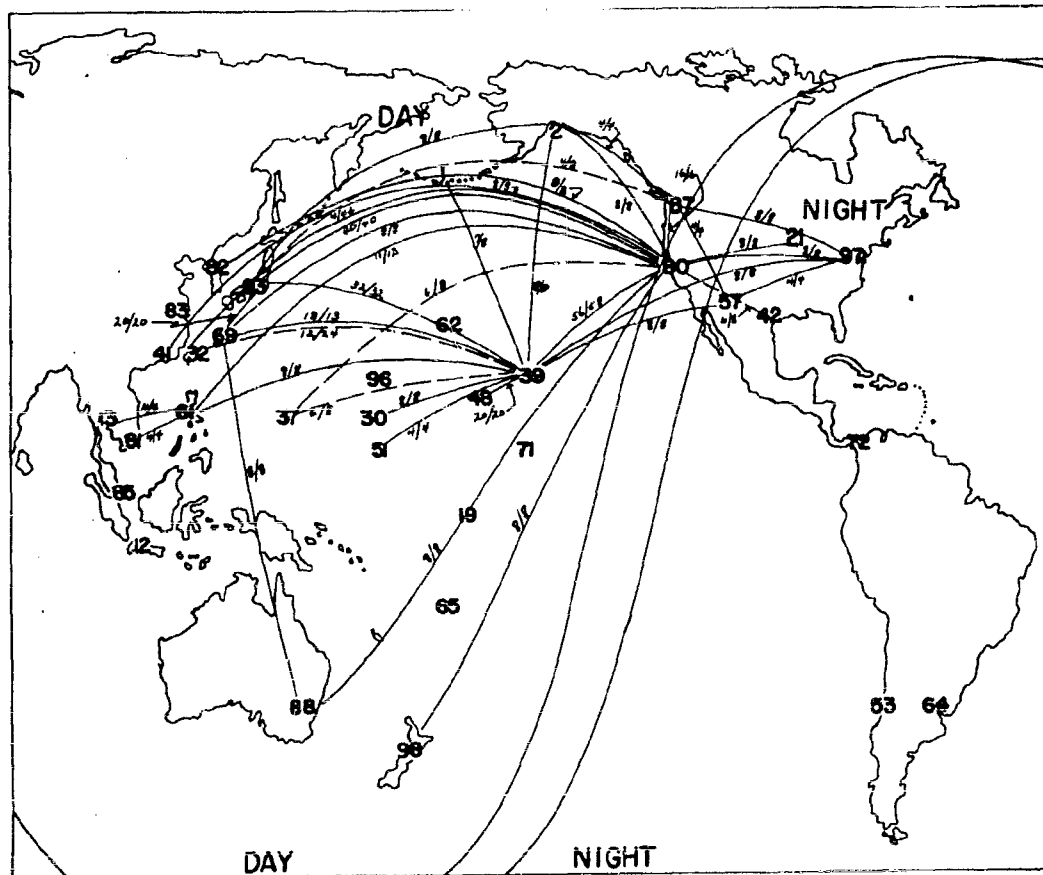
- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: - - - - -
- 80% to 100% of frequencies tried were useful: - - - - -
- ( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours,  
denominator is 4 x (number of frequency hours attempted  
during hour interval depleted.)

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0300Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

TIME INTERVAL CENTERED ON: 0300Z

[illegible]

### KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: -----  
30% to 80% of frequencies tried were useful: -----  
80% to 100% of frequencies tried were useful: -----

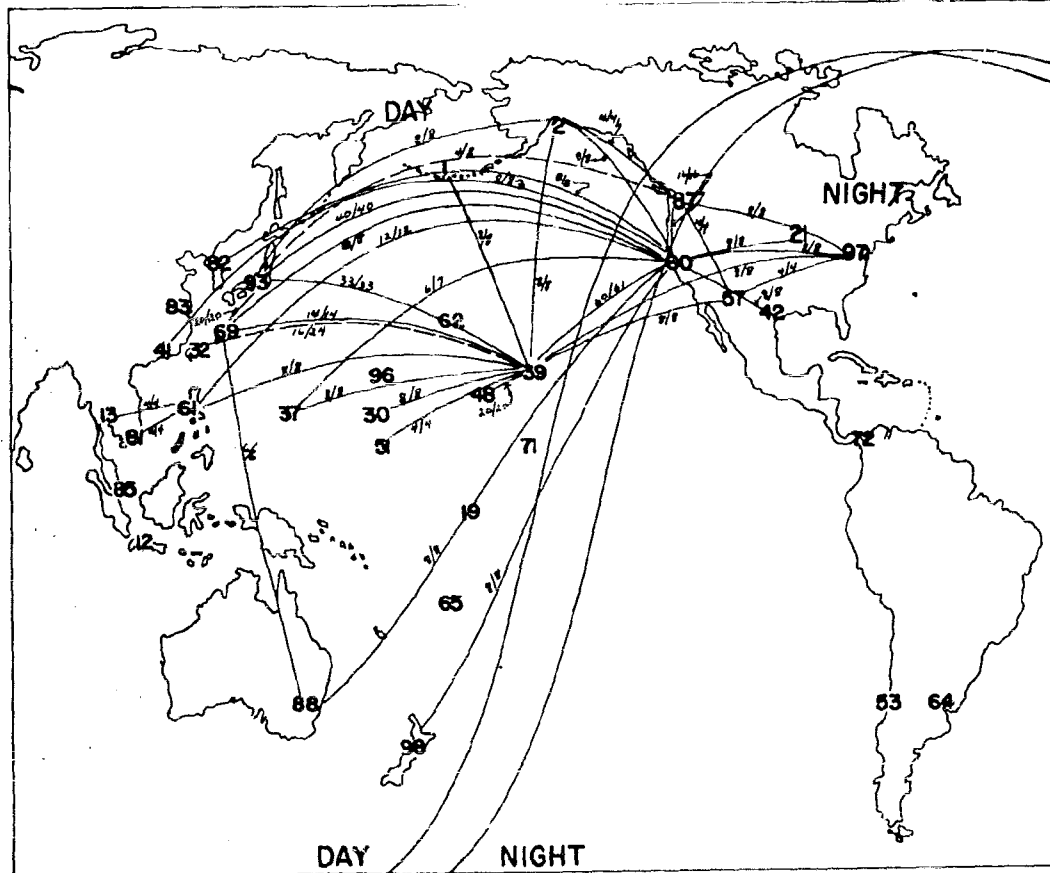
(/ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depleted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0400Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

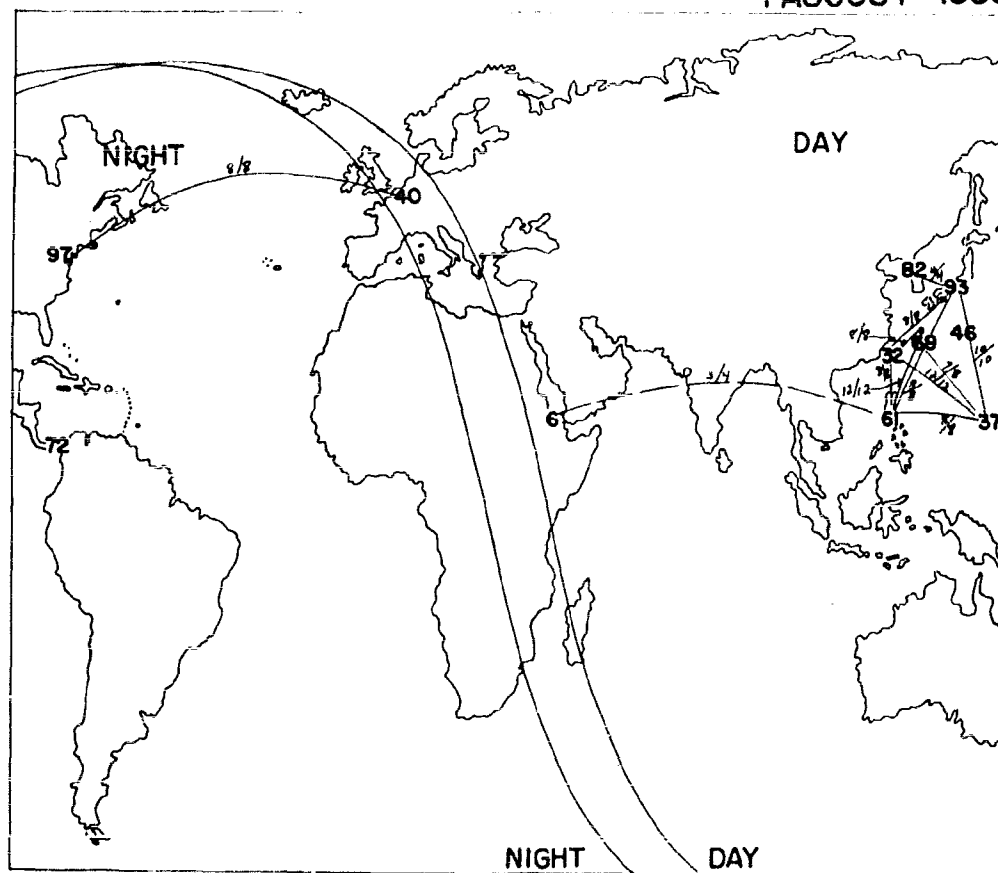
- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAX        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTICRANDE     | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANTA        | 69. OKINAWA         | 83. SHANGHAI       |

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0400Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 89. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

5% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: ————

80% to 100% of frequencies tried were useful: —————

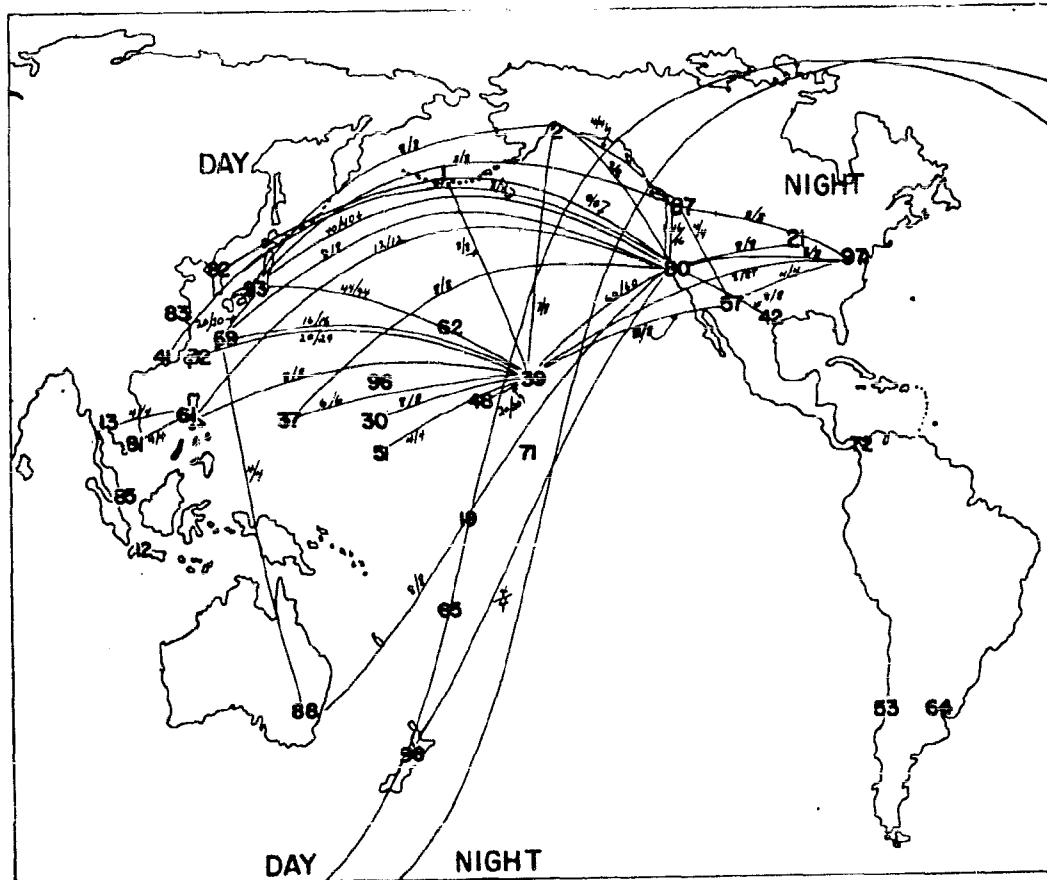
( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0500Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

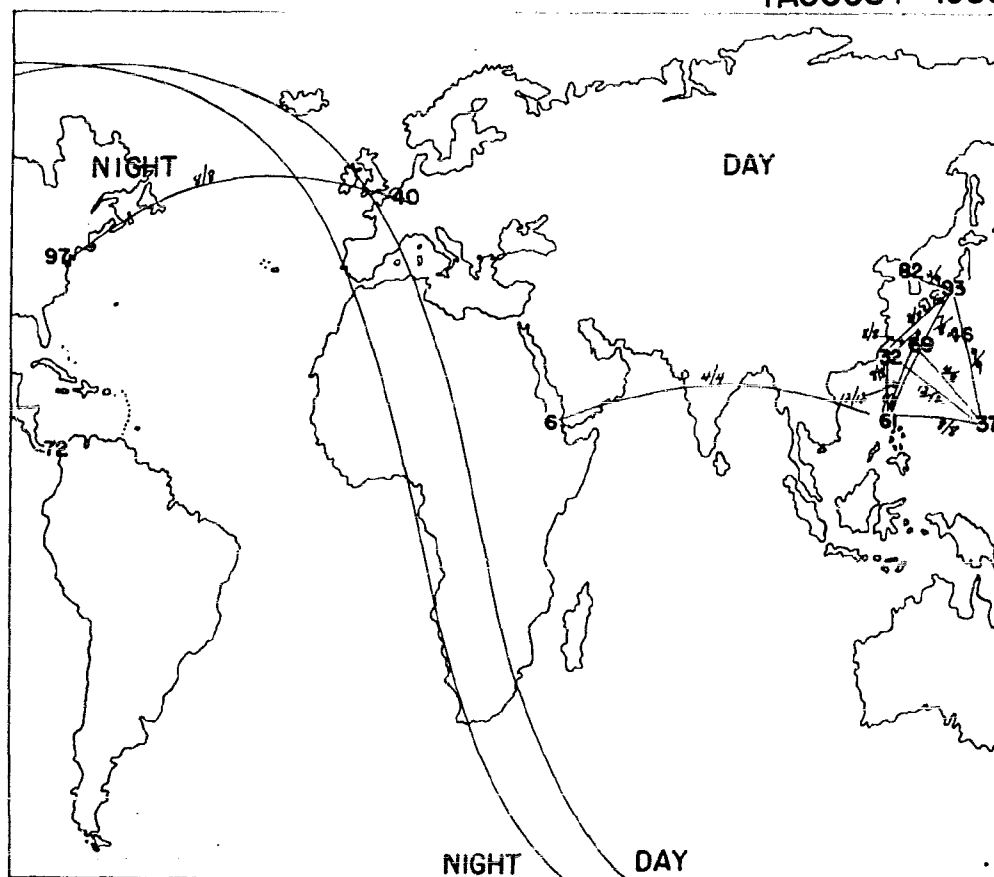
1. ADAX	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMIRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAEON
12. BANGKOK	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANCE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

# **SECRET** **SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE** **DURING TIME INTERVAL OF ONE HOUR ALONG** **SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0500Z

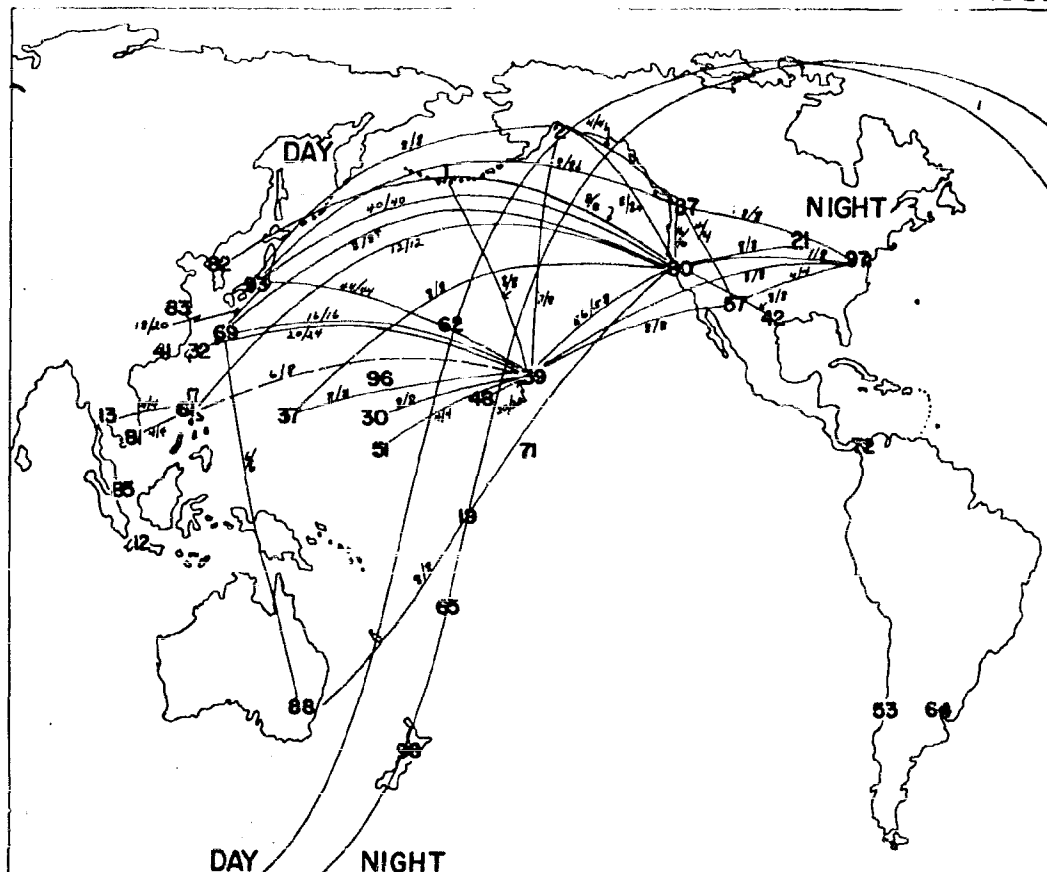
1 AUGUST 1958



**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0600Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

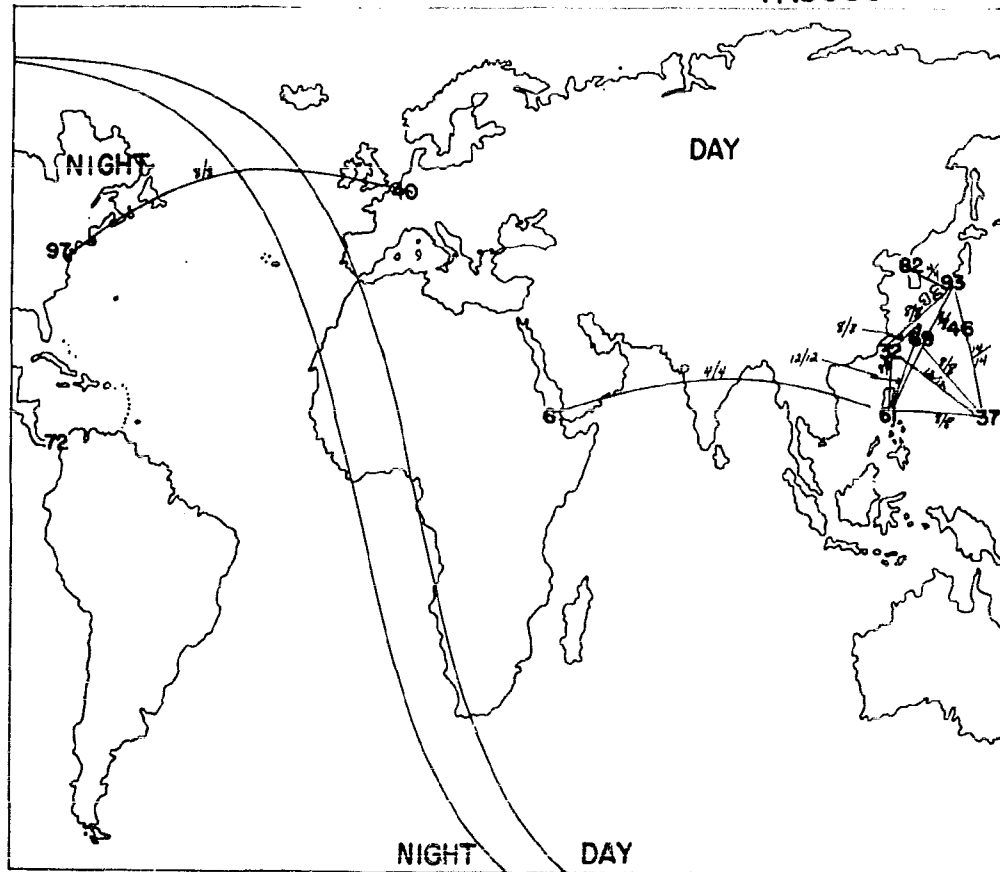
1. ADAM	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PAKOTA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0600Z

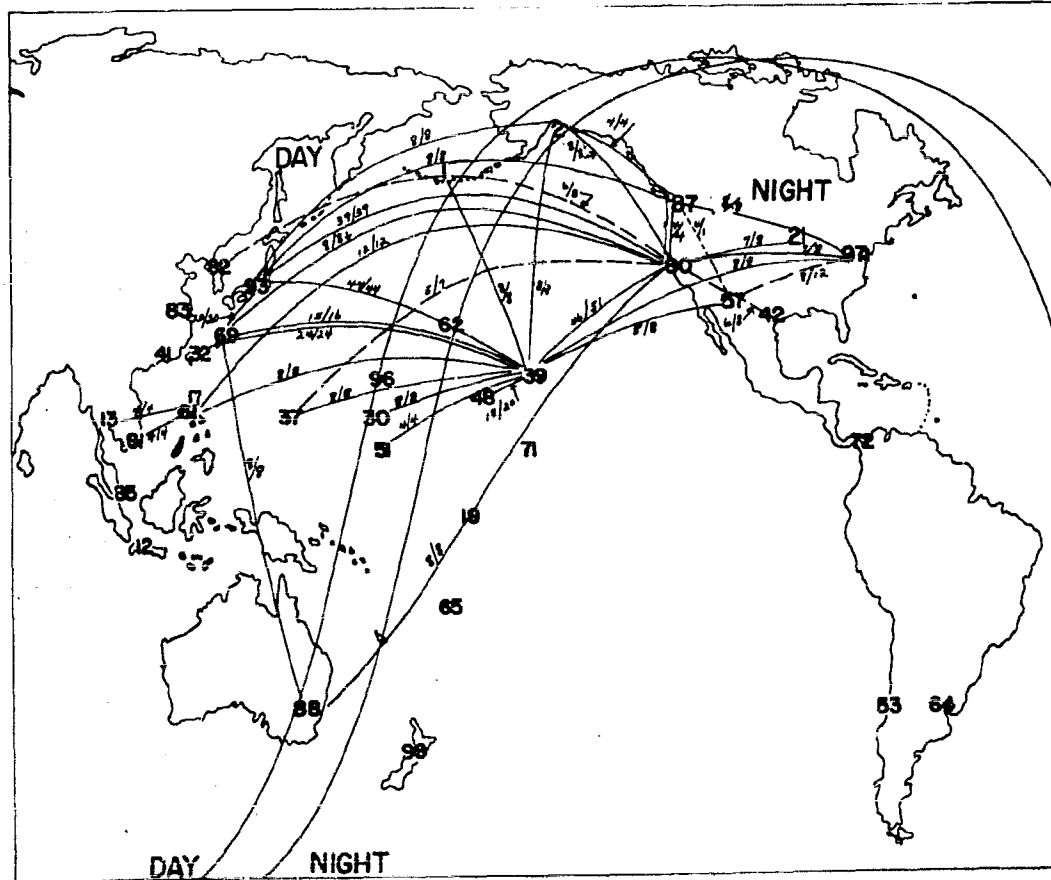
1 AUGUST 1958



**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0700Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

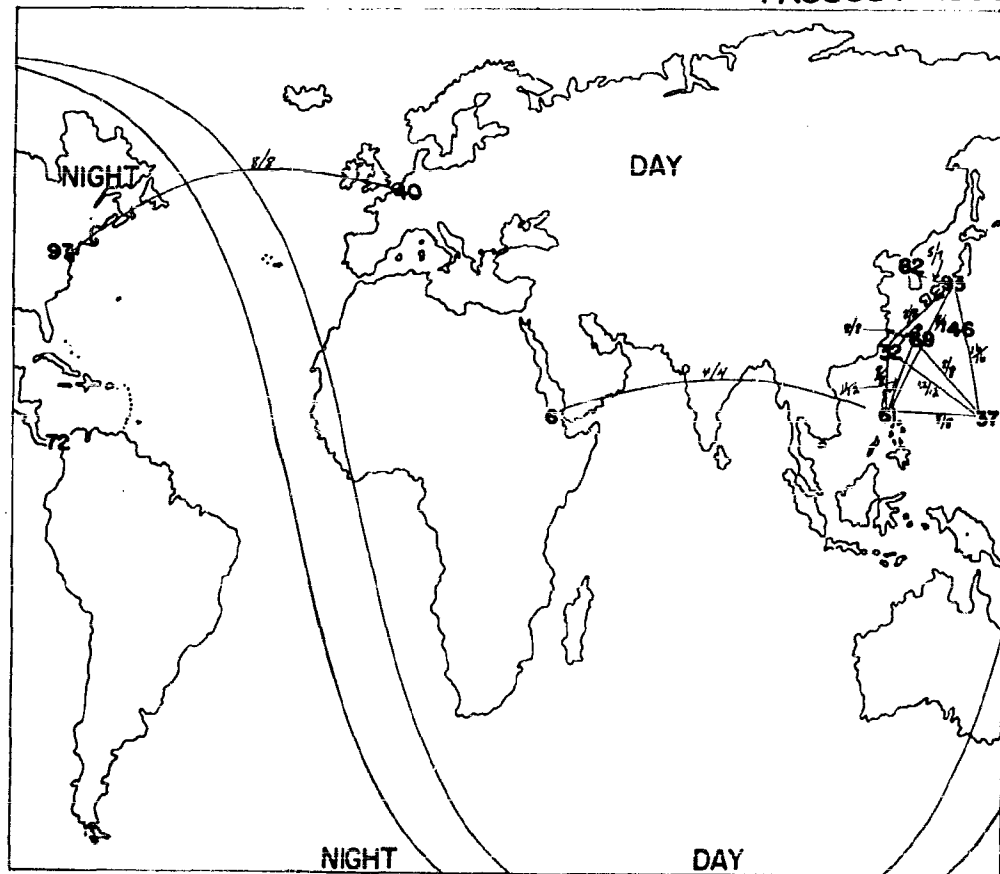
Figure 48a

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 0700 Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS:

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

KEY TO FREQUENCY UTILITY

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: - - - - -

80% to 100% of frequencies tried were useful: - - - - -

( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)

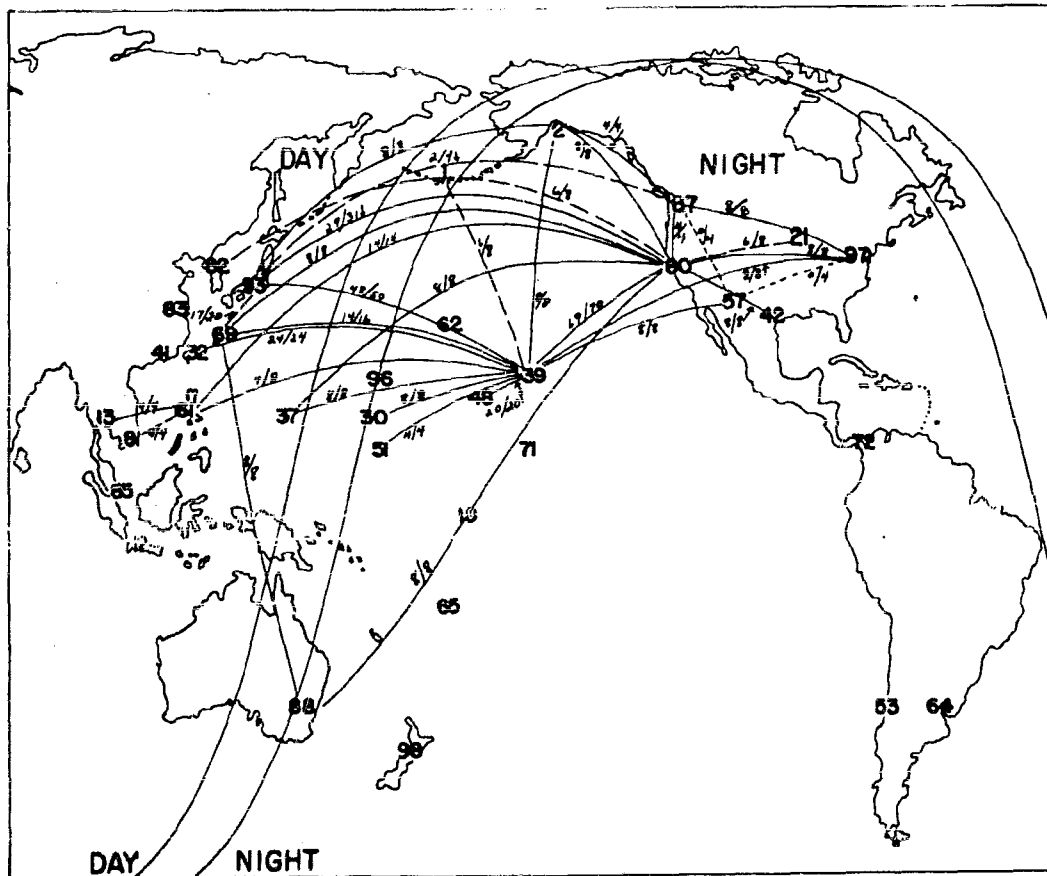
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

# SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0800Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

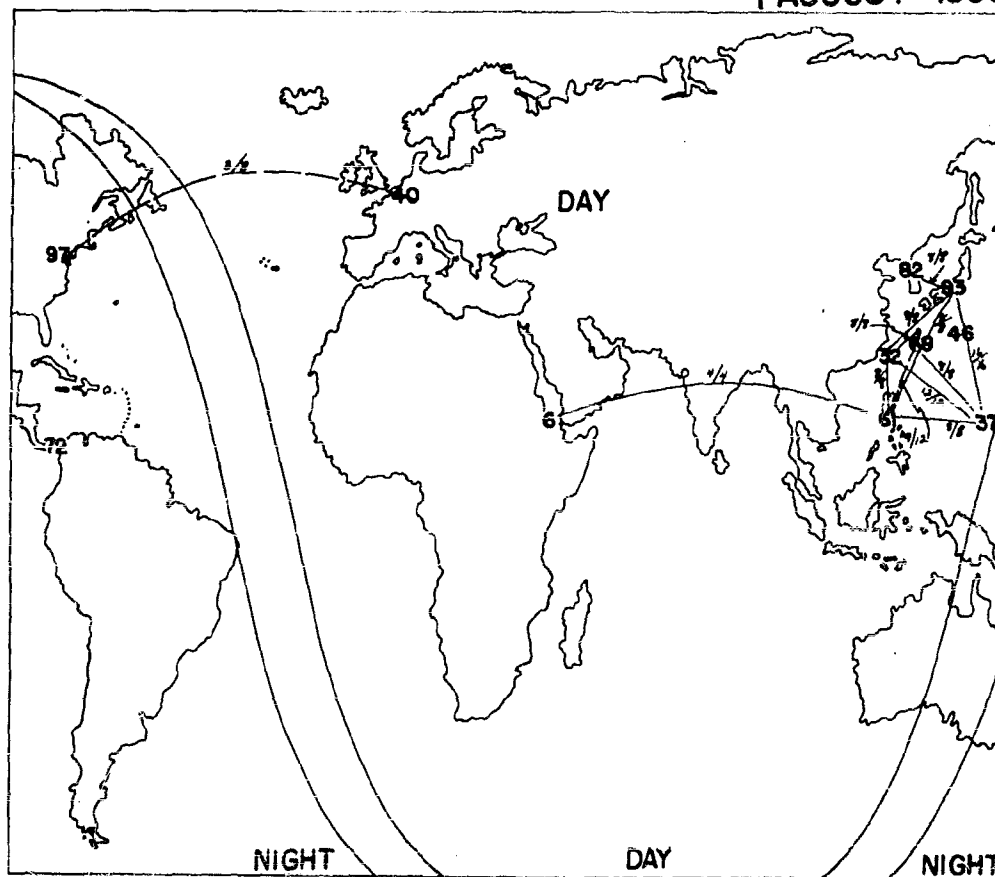
1. ADAX	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEIGUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0800 Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: — — — — —

80% to 100% of frequencies tried were useful: —————

( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)

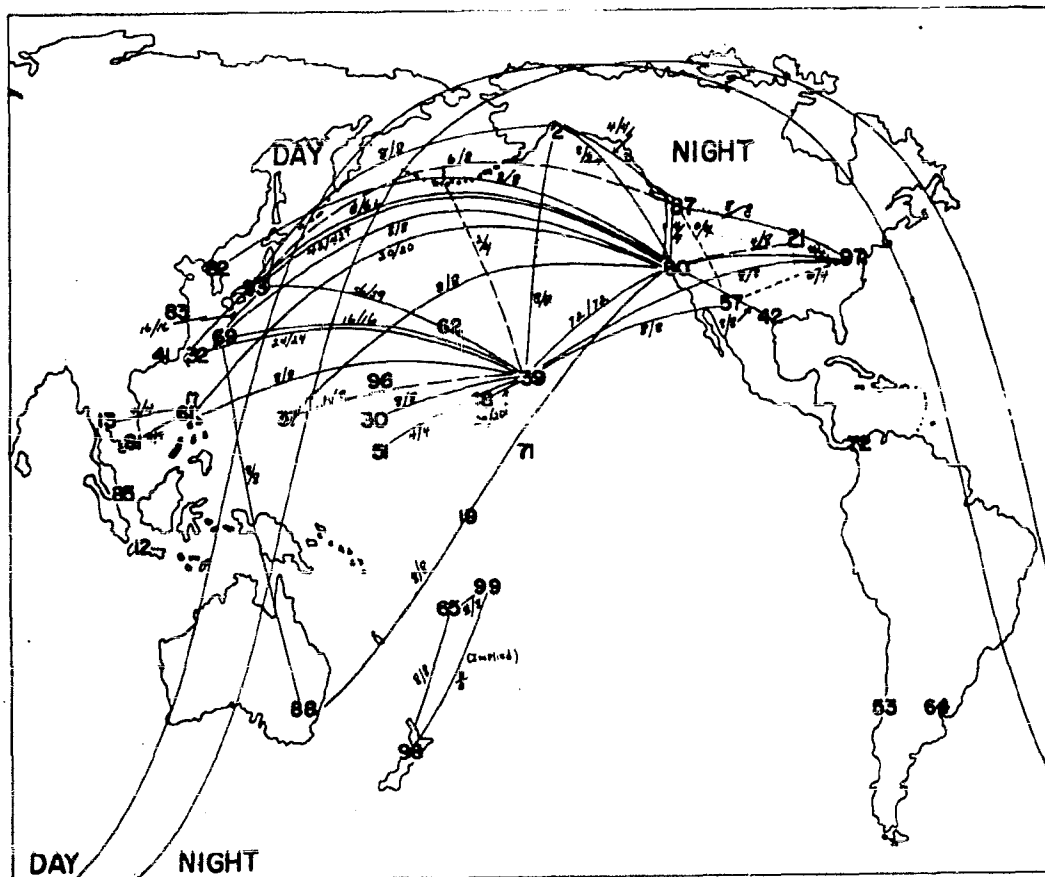
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0900Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

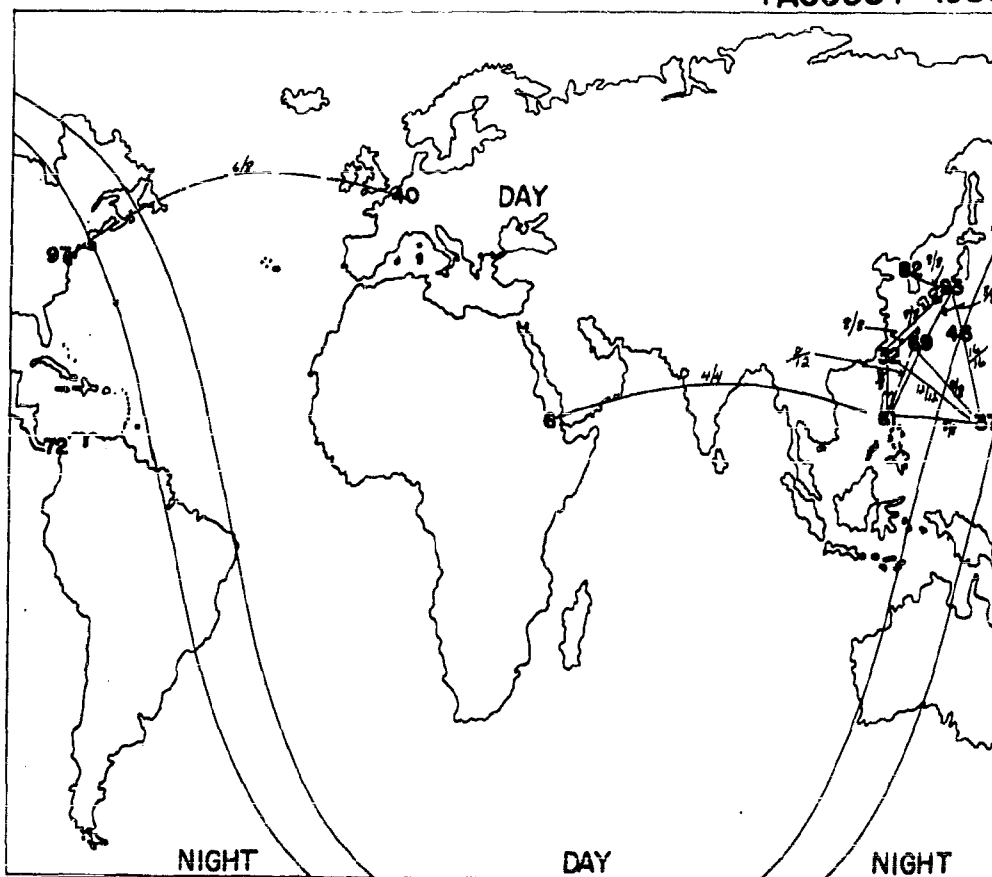
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANGUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0900 Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: -----
- 30% to 80% of frequencies tried were useful: \_\_\_\_\_
- 80% to 100% of frequencies tried were useful: \_\_\_\_\_

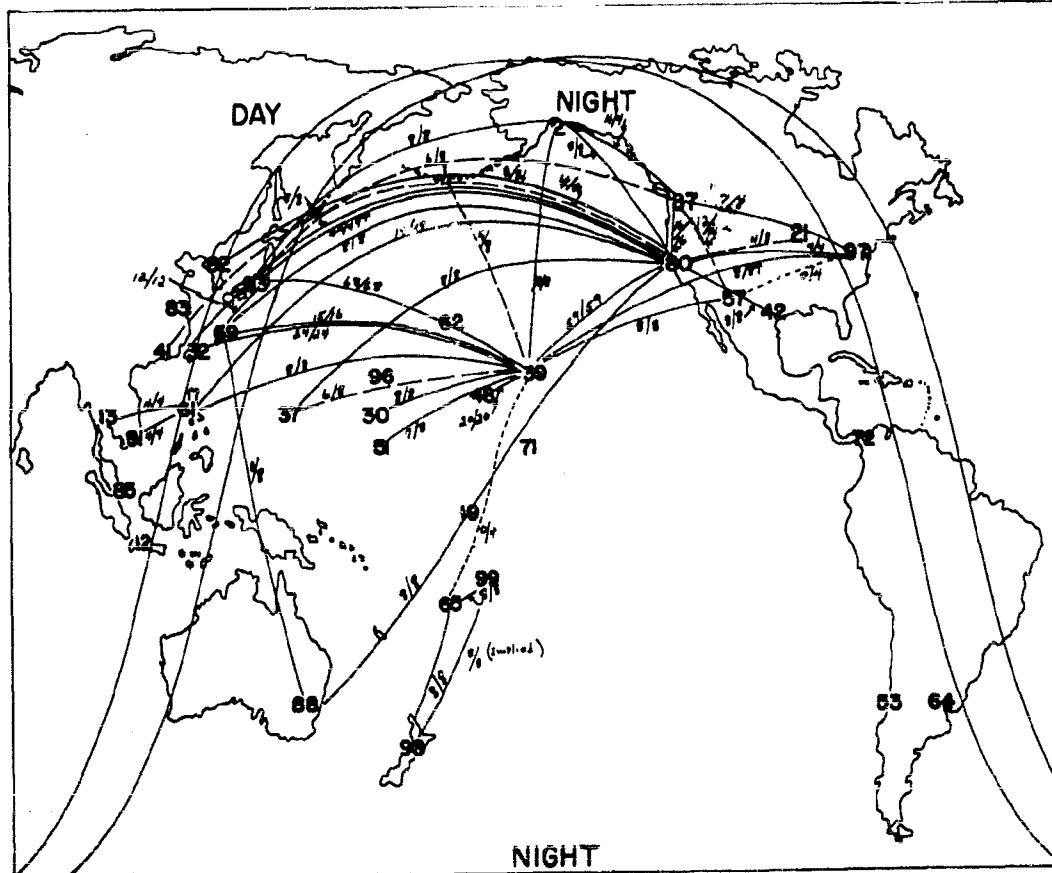
( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1000Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

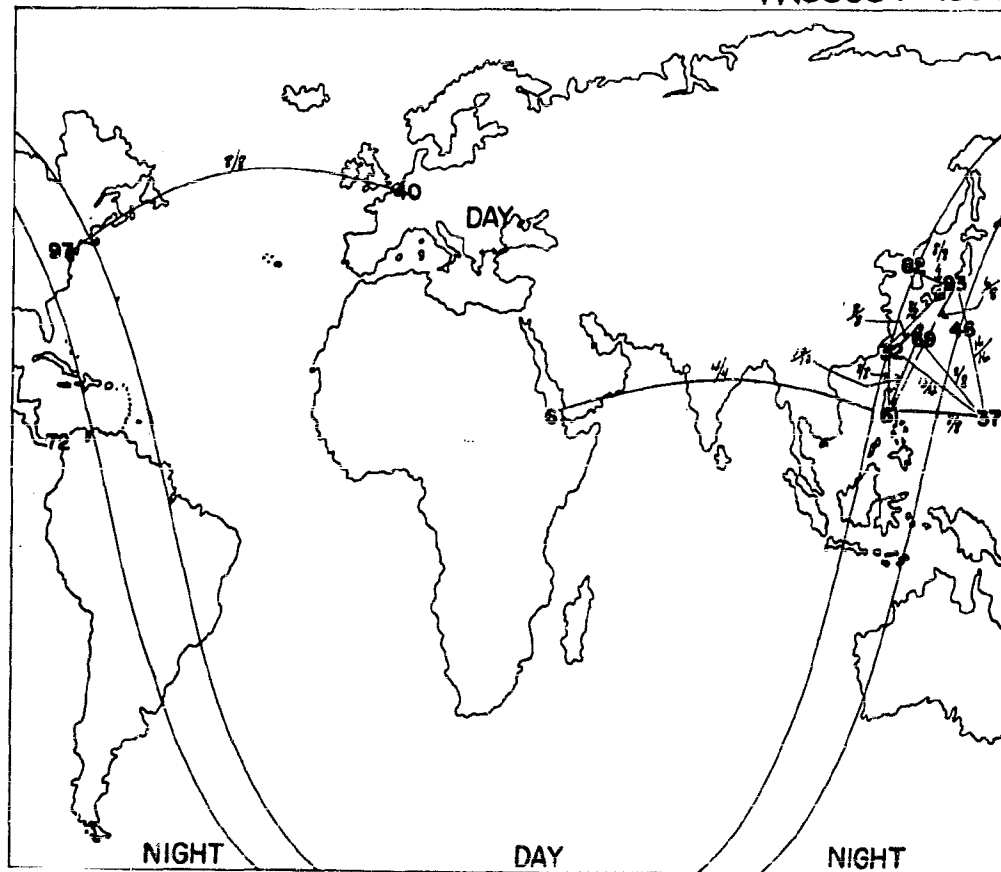
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASHARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. GANTON IS.	40. HEIDELBERG	53. LA ORANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

# **SECRET** **SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE** **DURING TIME INTERVAL OF ONE HOUR ALONG** **SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1000 Z

1 AUGUST 1958



## **KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

## **KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: - - - - -

80% to 100% of frequencies tried were useful: - - - - -

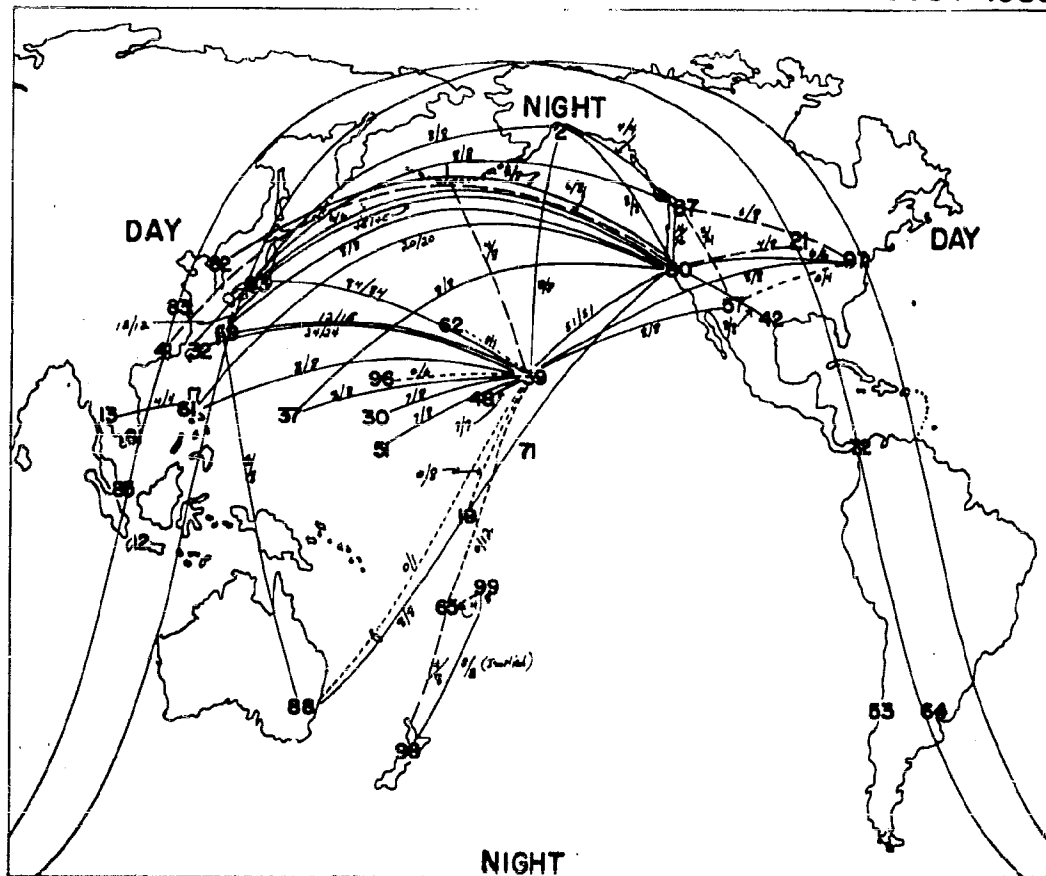
( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1030Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. TWO JIMA	62. MIDWAY	81. SAIGON
12. BANGKOK	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

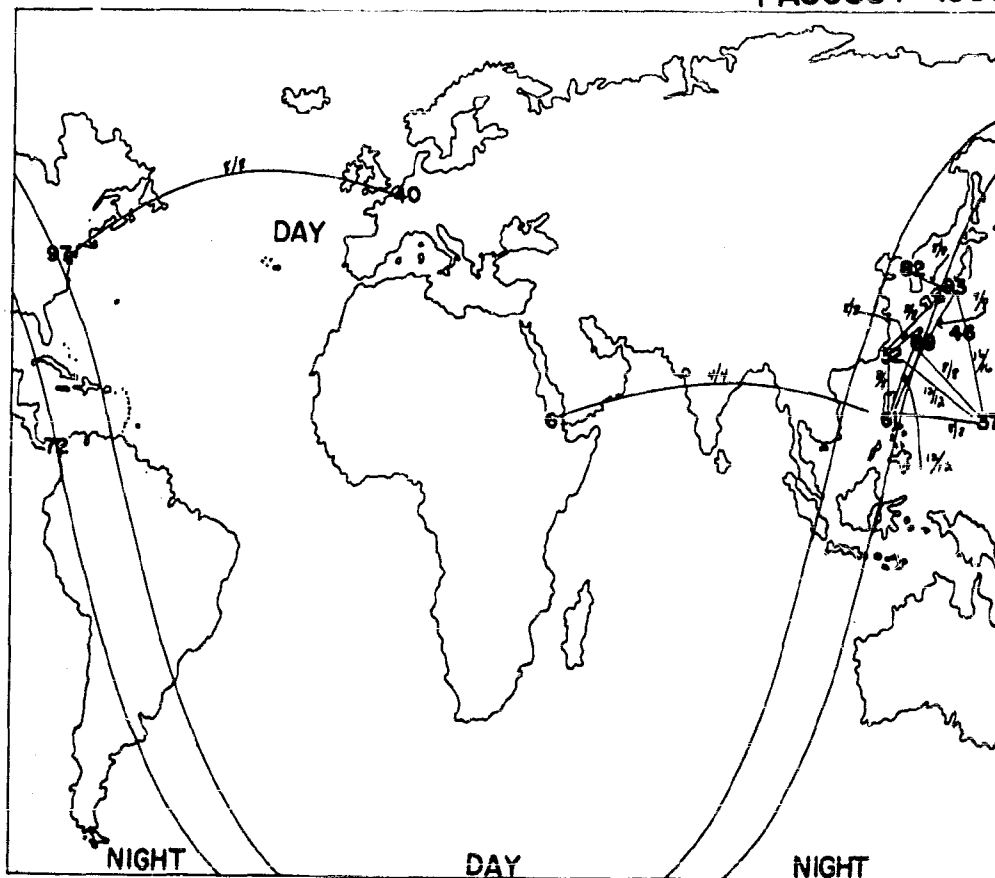
Figure 52a

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1030Z

1 AUGUST 1958

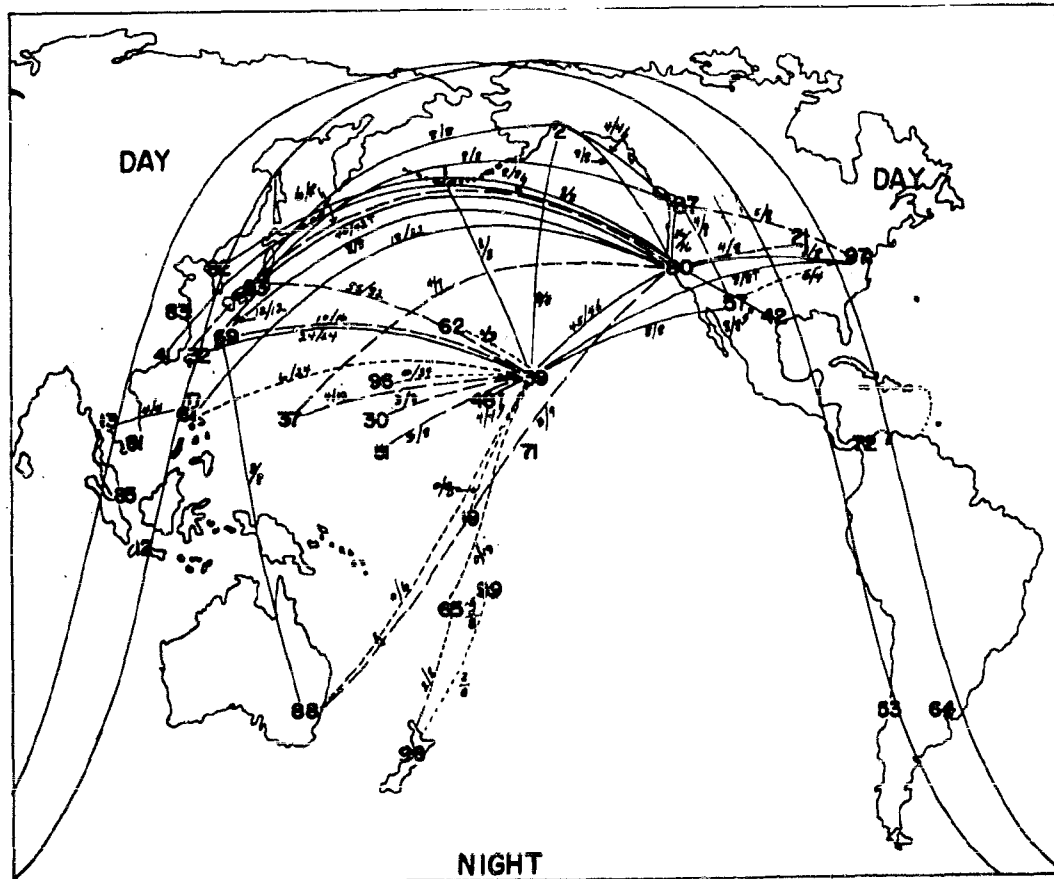


SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1100Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |                |               |                      |                     |                    |
|----------------|---------------|----------------------|---------------------|--------------------|
| 1. ADAX        | 21. CHICAGO   | 41. HONOLULU         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANKORAGE    | 30. ENIWETOK  | 42. HOUSTON, TX. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA   | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANGKOK    | 37. GUAM      | 48. JOHNSTON IS.     | 64. MONTICORNE      | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII    | 51. KWAJALEIN        | 65. NANTY, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. KIEHLBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

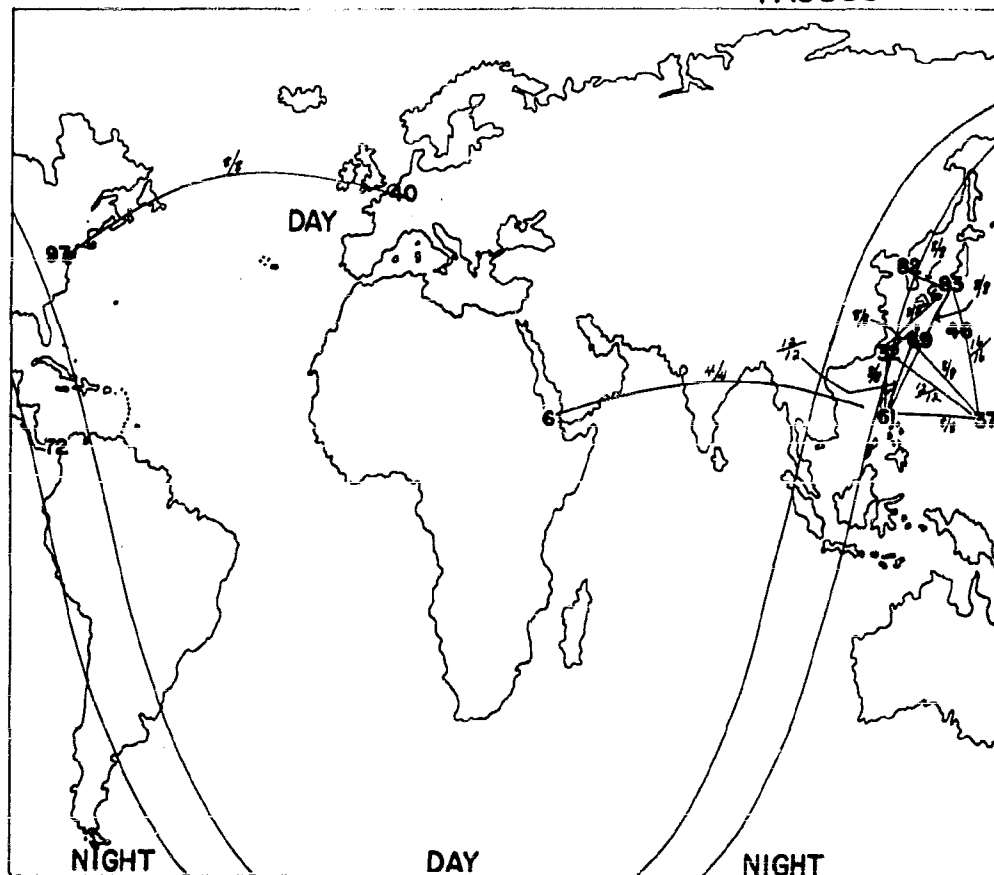
SECRET

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1100 Z

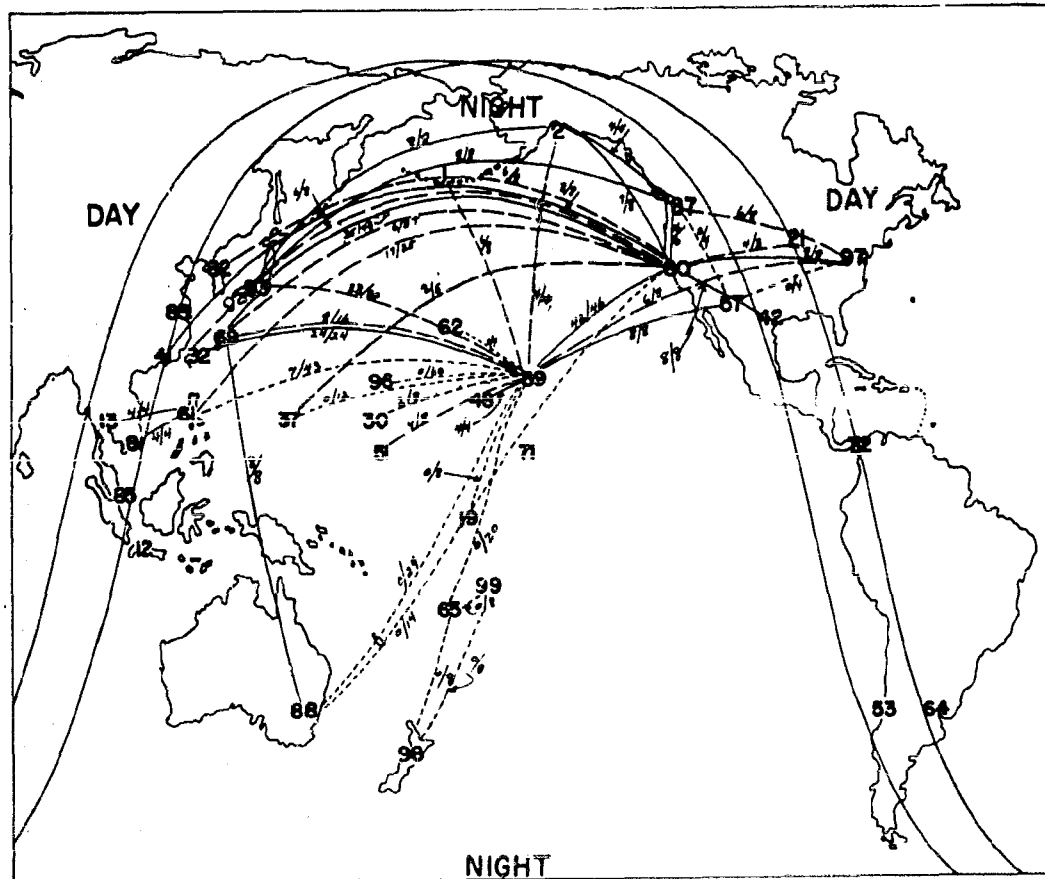
1 AUGUST 1958



**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1130Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

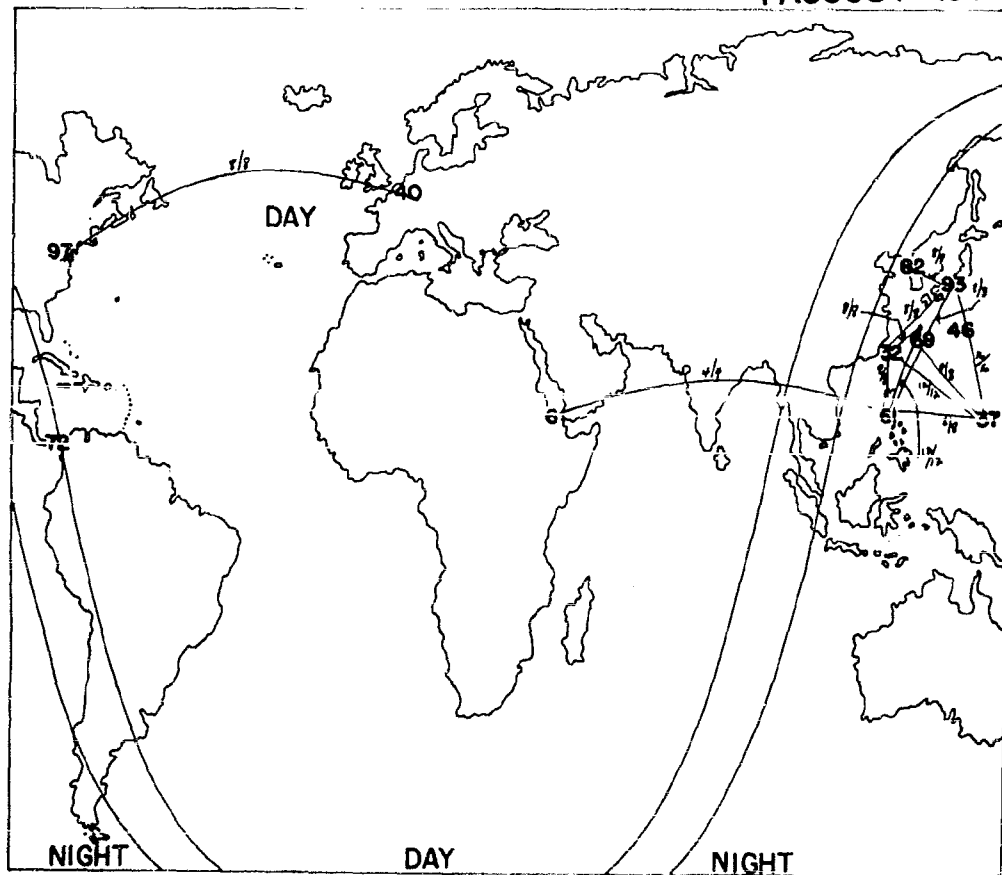
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1130Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 83. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: — — — — —

80% to 100% of frequencies tried were useful: —————

( ) - Numerator of fraction is 4 x (number of usable frequency hours)

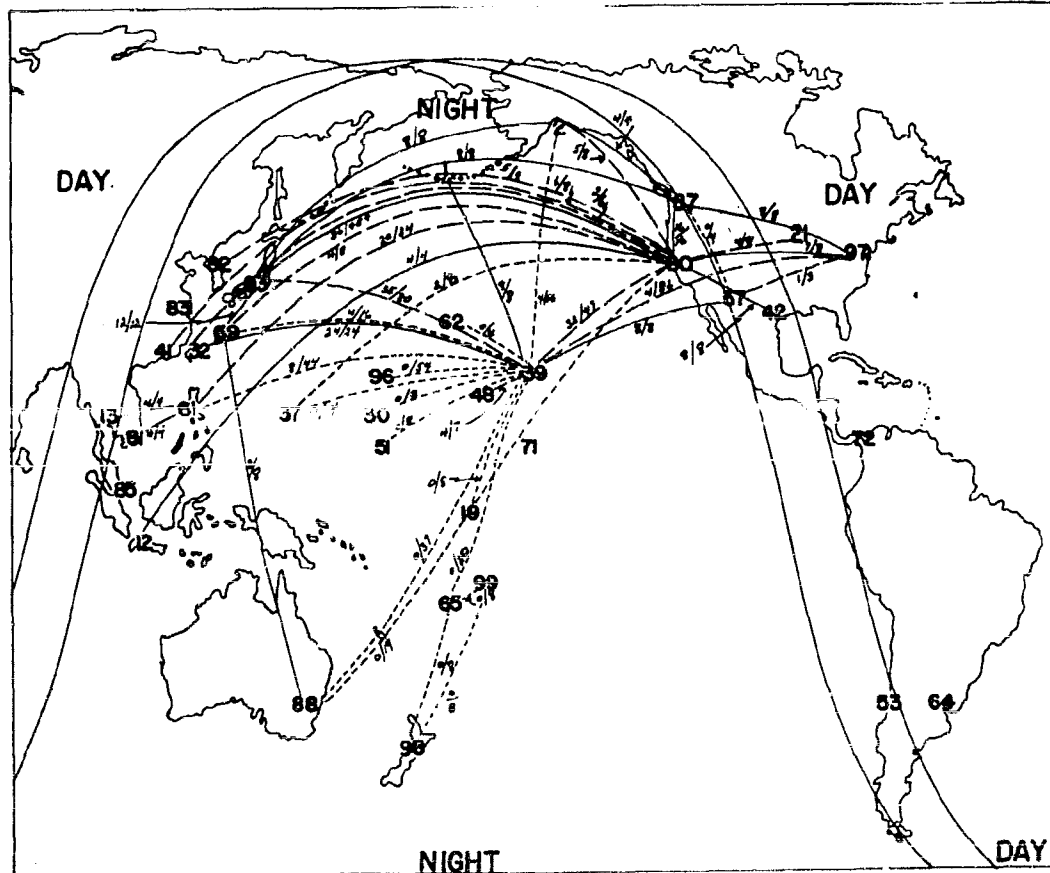
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1200Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

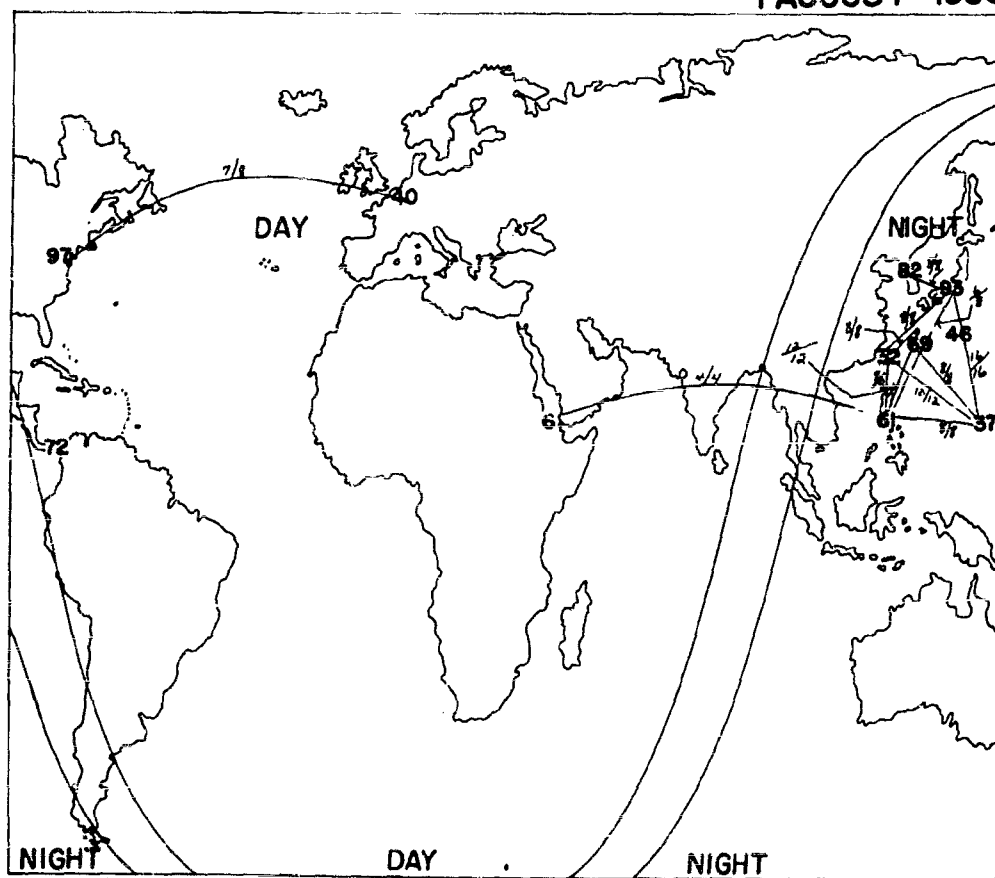
- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAX        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANGKOK    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTIGRANIE     | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1200Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————

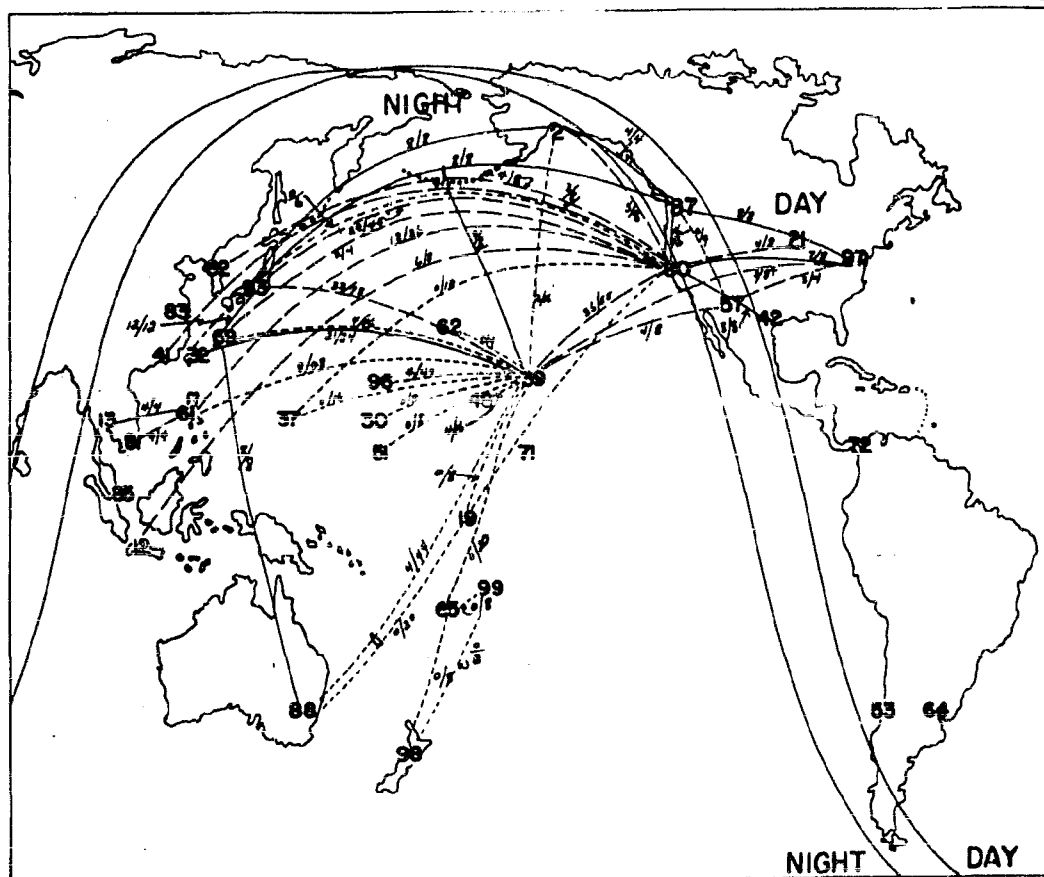
( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1230Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

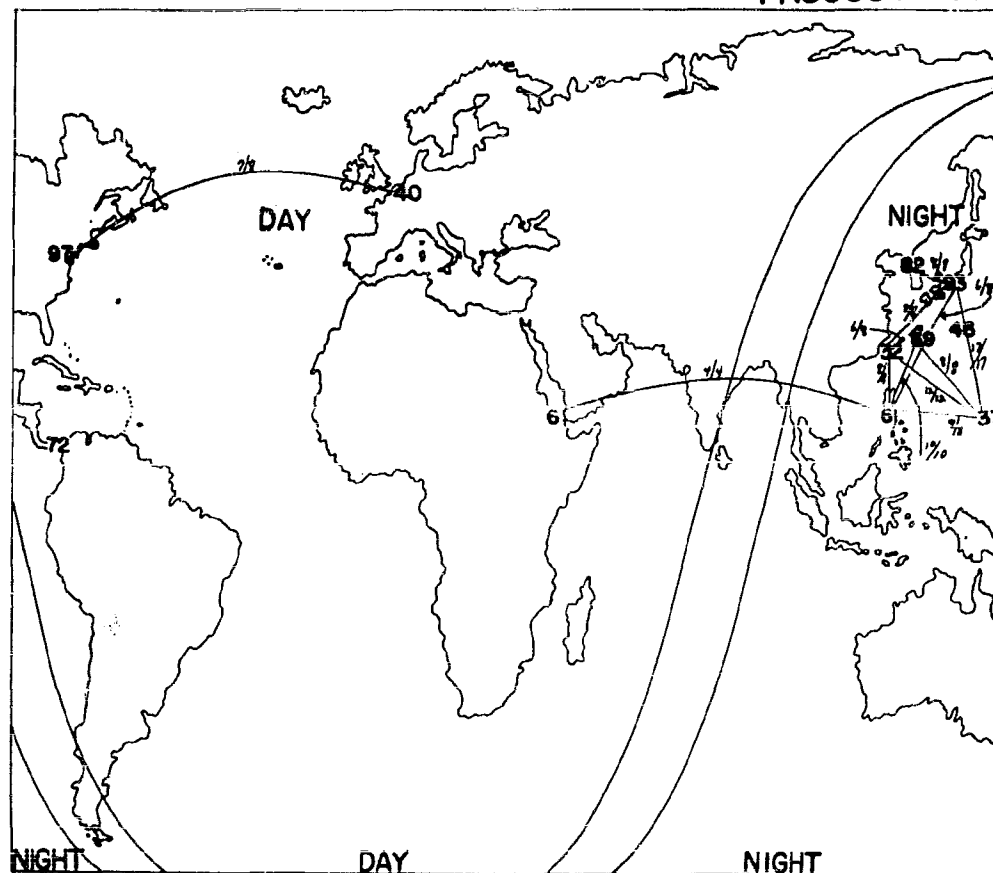
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASHARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1230Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: - - - - -
- 80% to 100% of frequencies tried were useful: - - - - -

( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

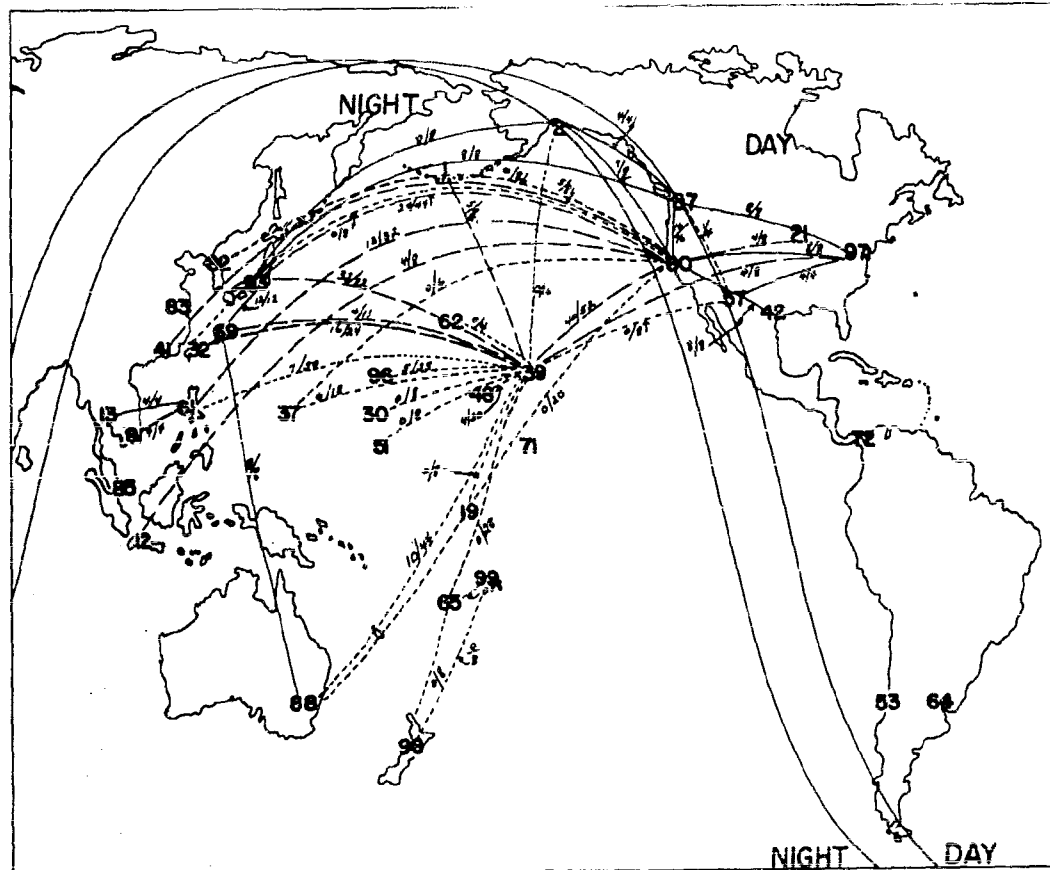
**SECRET**

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1300Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAM	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

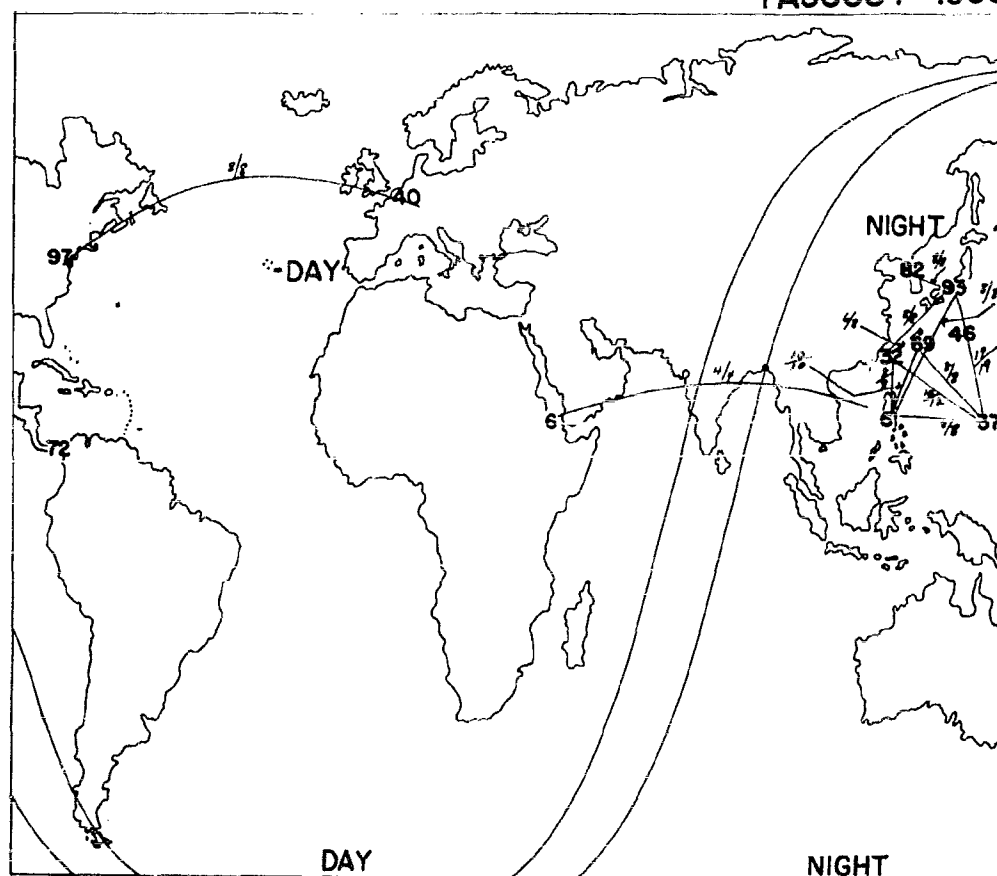
SECRET

Figure 57a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1300 Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 89. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————

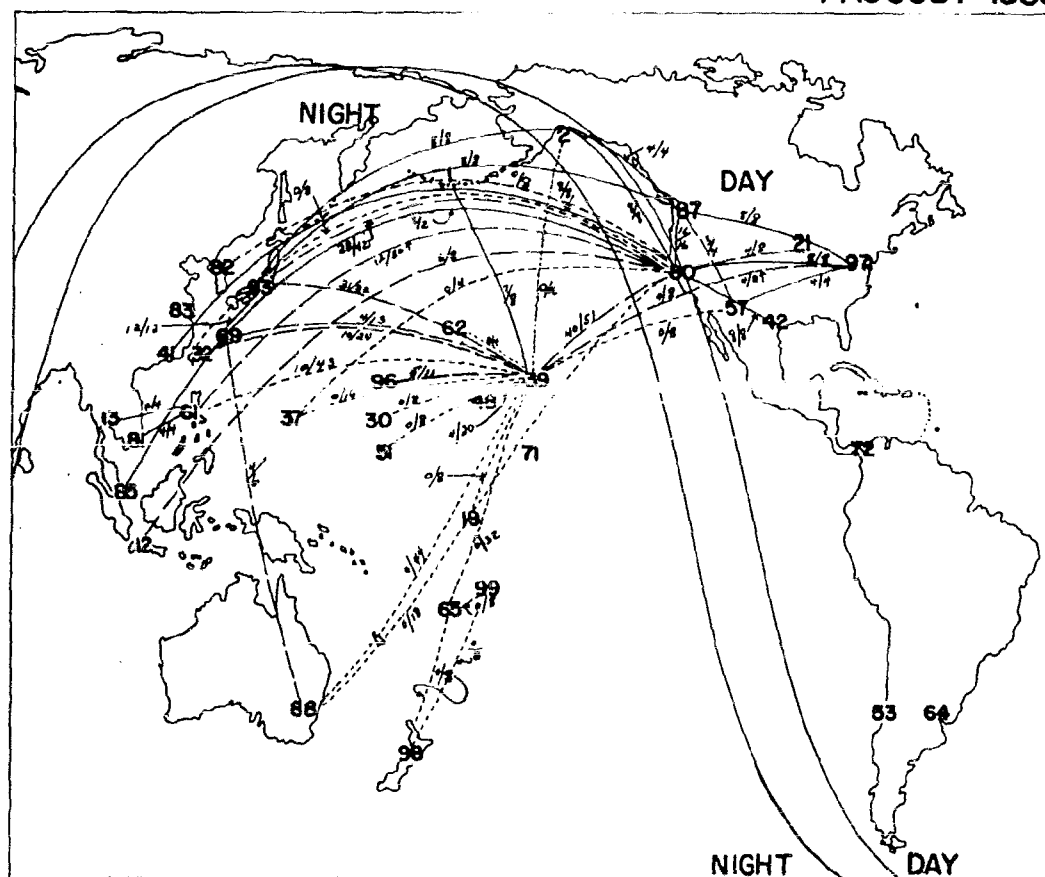
( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1330Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

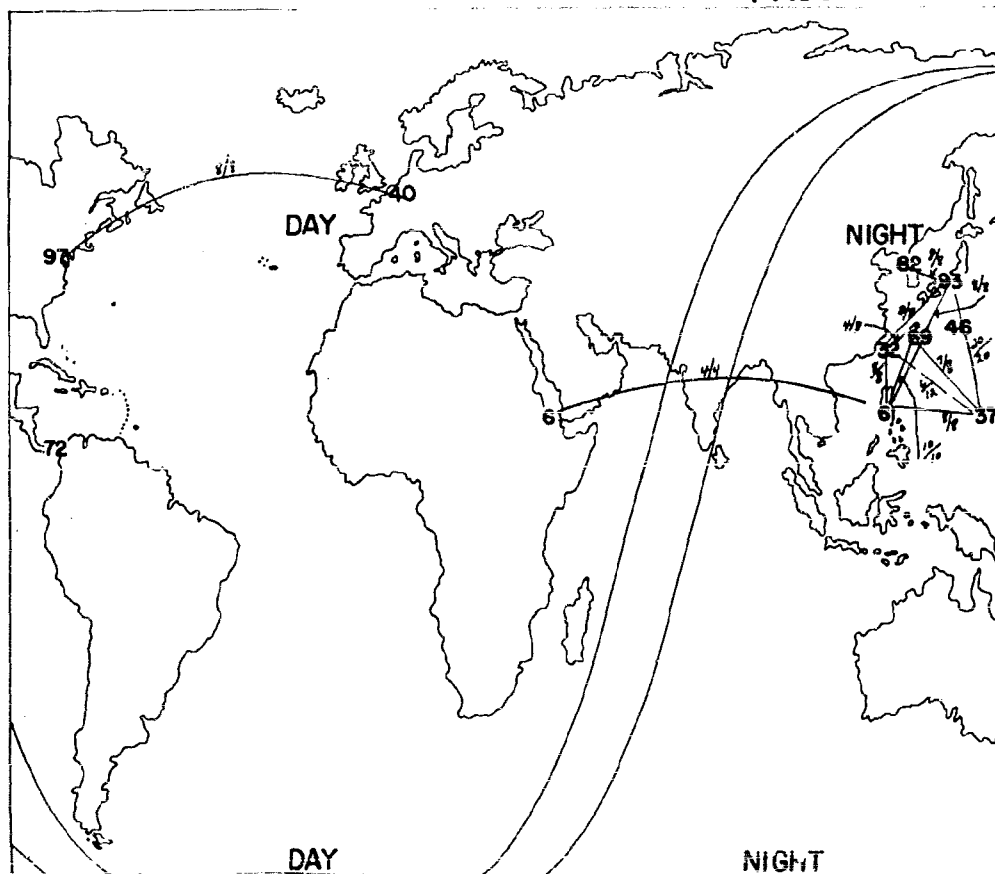
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDJUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORAN	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1330Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 95. SINGAPORE | 96. WAKE IS.         |
| 97. SEATTLE   | 97. WASHINGTON, D.C. |
| 98. SYDNEY    | 98. WELLINGTON       |
| 99. TOKYO     | 99. SAMOA IS.        |

KEY TO FREQUENCY UTILITY

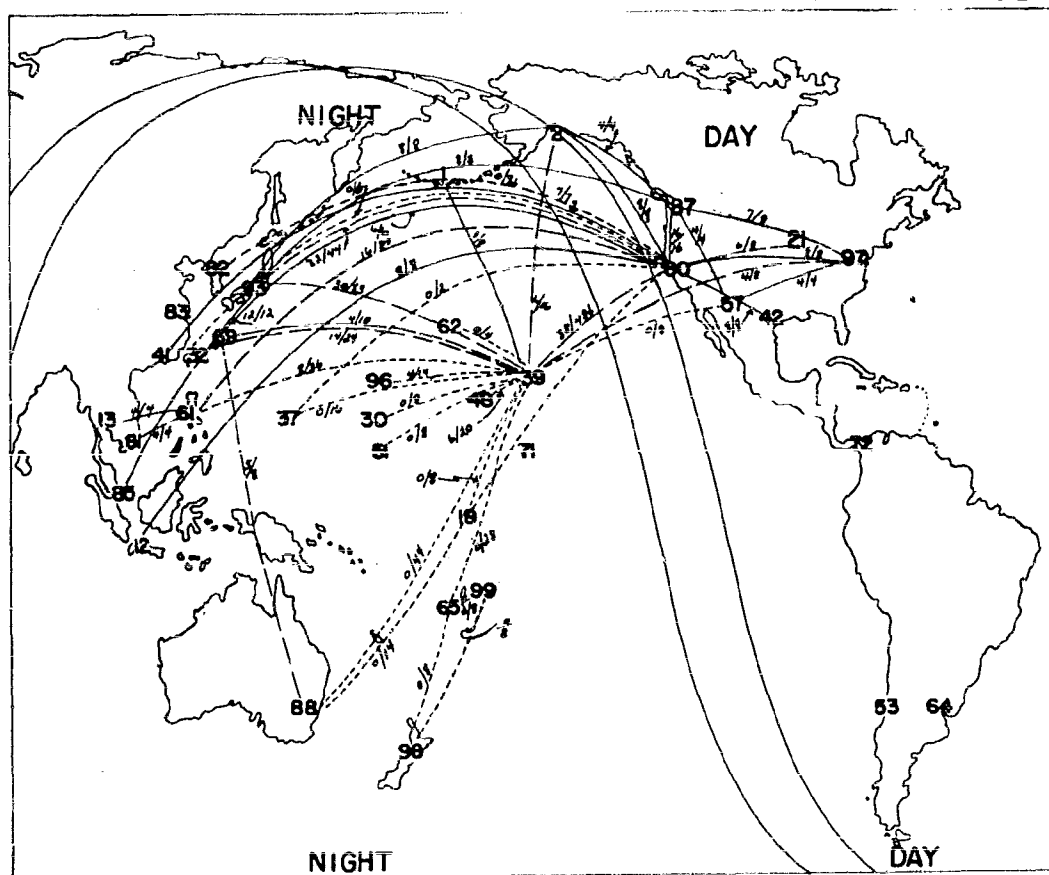
- 0% to 30% of frequencies tried were useful: -----
- 30% to 80% of frequencies tried were useful: - - - - -
- 80% to 100% of frequencies tried were useful: \_\_\_\_\_
- ( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1400Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IRO JIMA	62. MIDWAY	81. SAIGON
12. BAKHUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANLE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

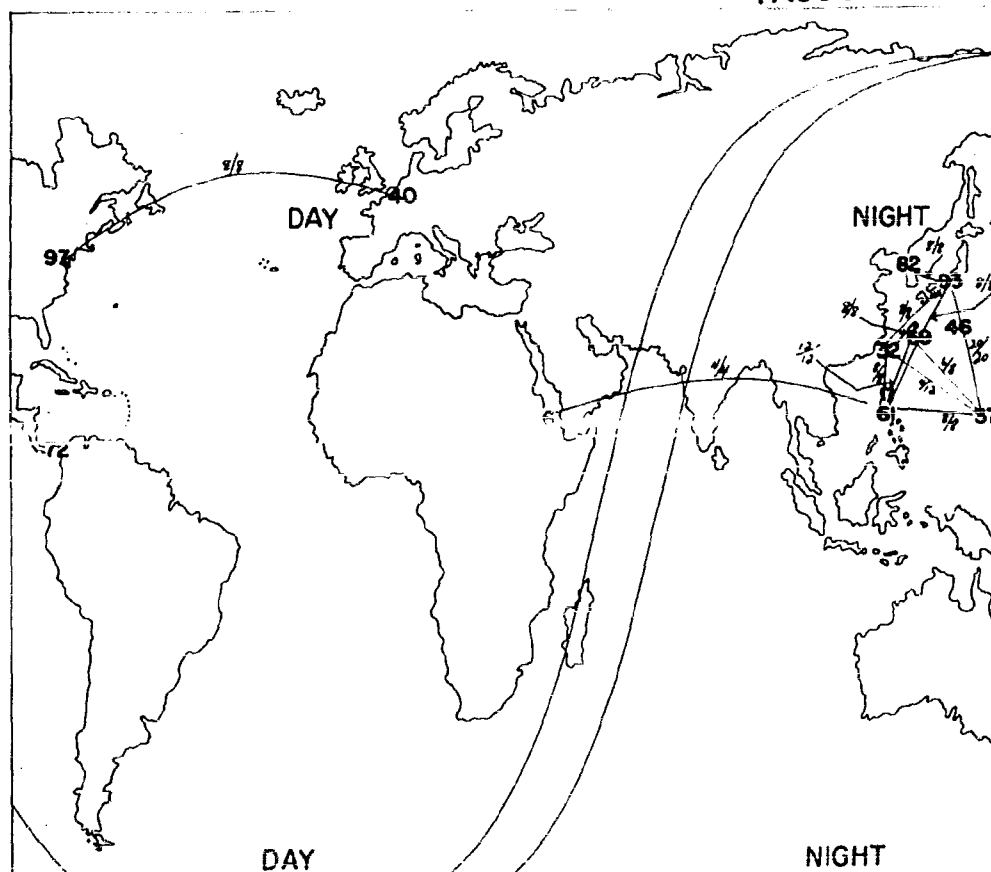
**SECRET**

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1400Z

1 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

### KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: -----
- 30% to 80% of frequencies tried were useful: \_\_\_\_\_
- 80% to 100% of frequencies tried were useful: \_\_\_\_\_

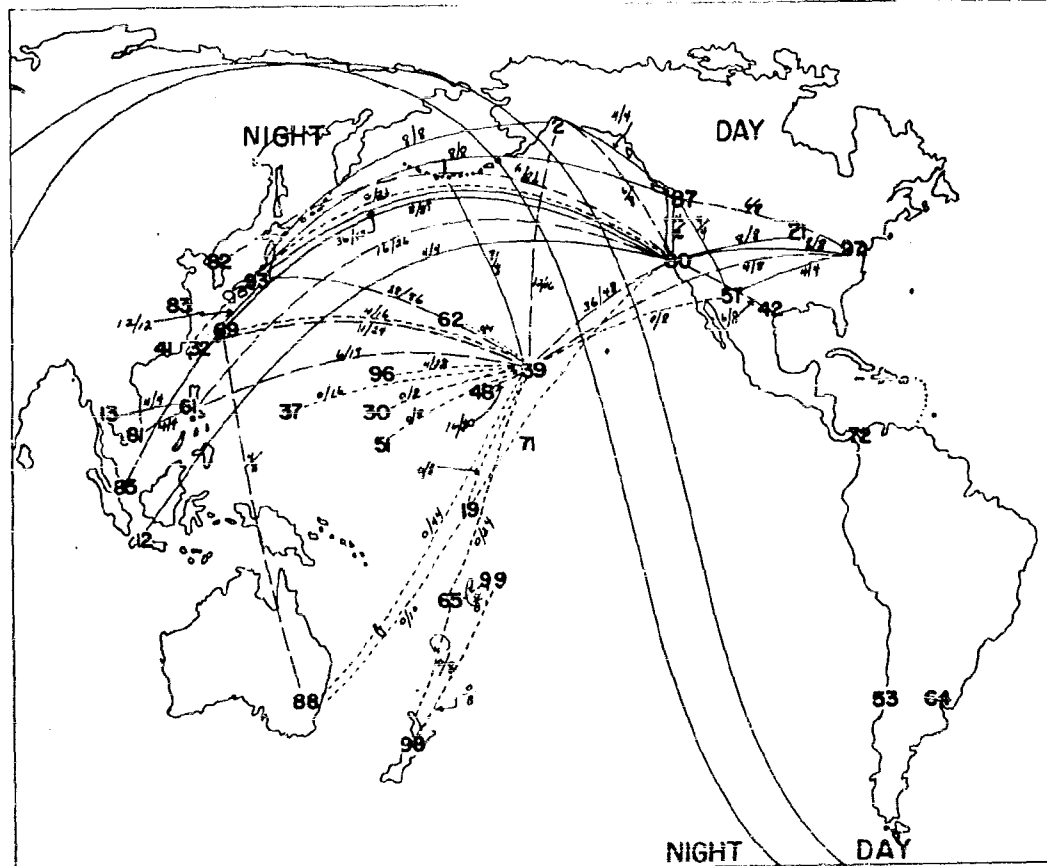
( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

# SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1430Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANGUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEINZBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

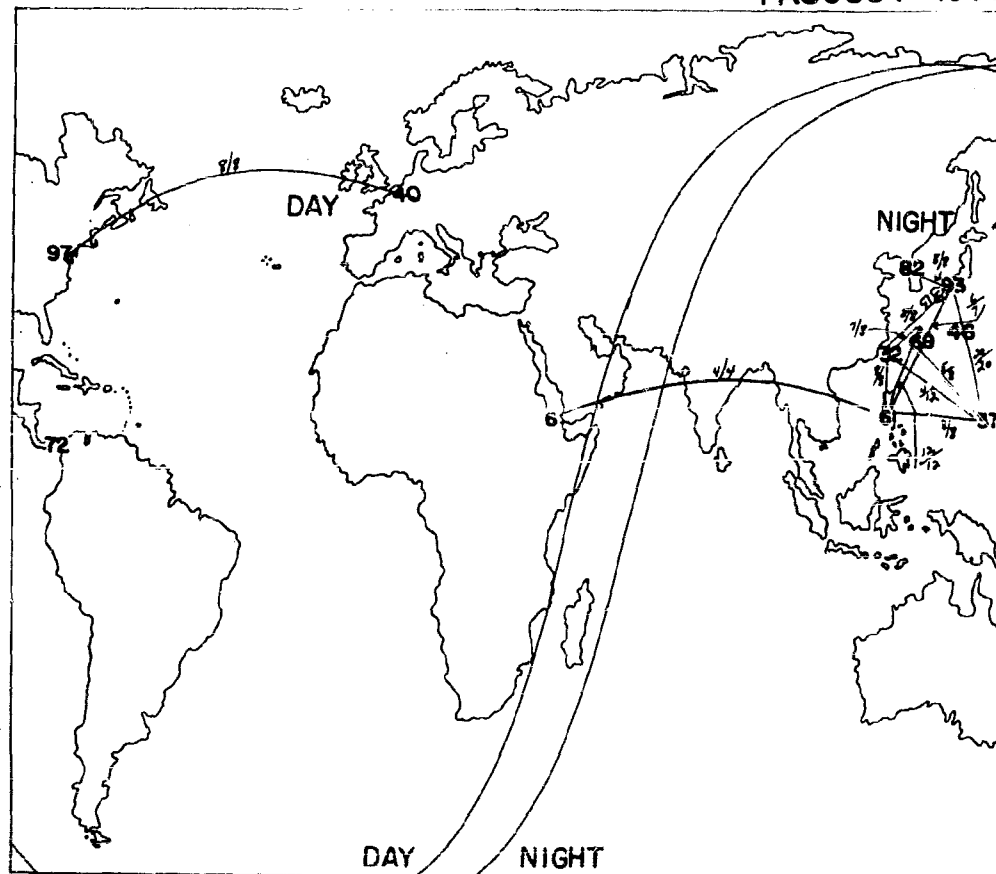
Figure 60a

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1430Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SAMOA IS.

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -  
 30% to 80% of frequencies tried were useful: - - - - -  
 80% to 100% of frequencies tried were useful: - - - - -

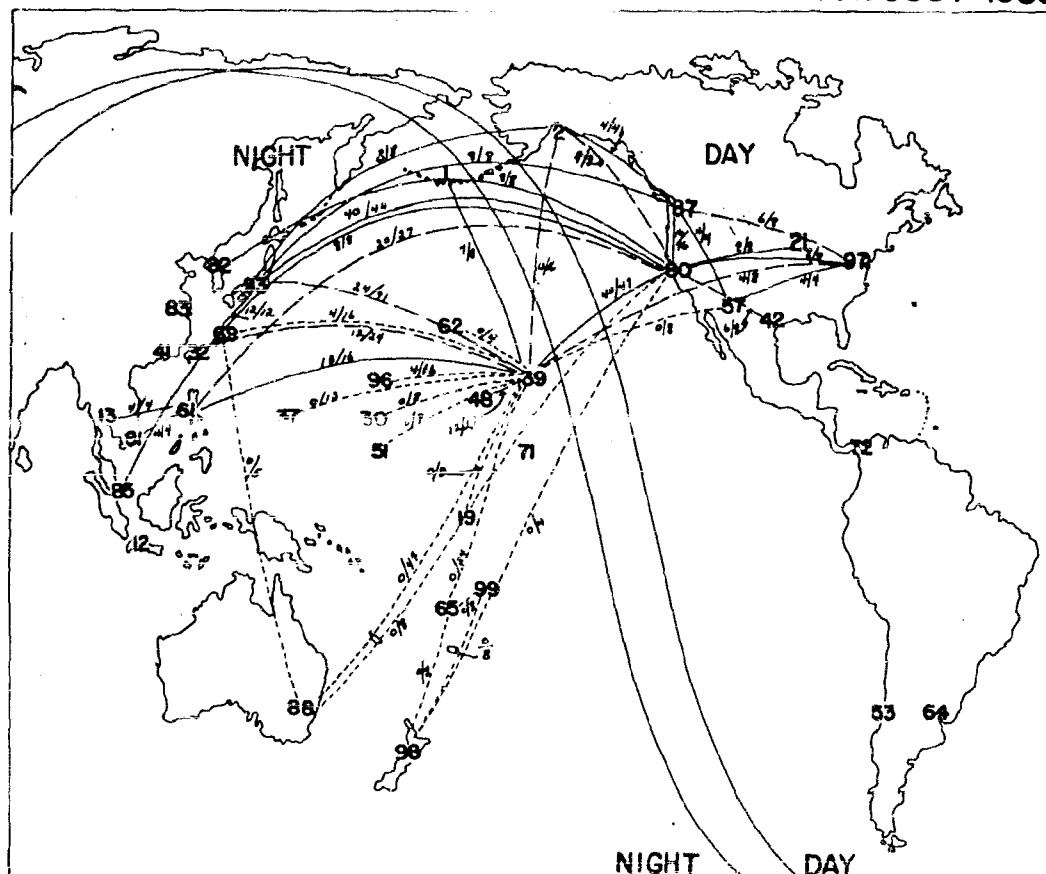
( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1500Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENHETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

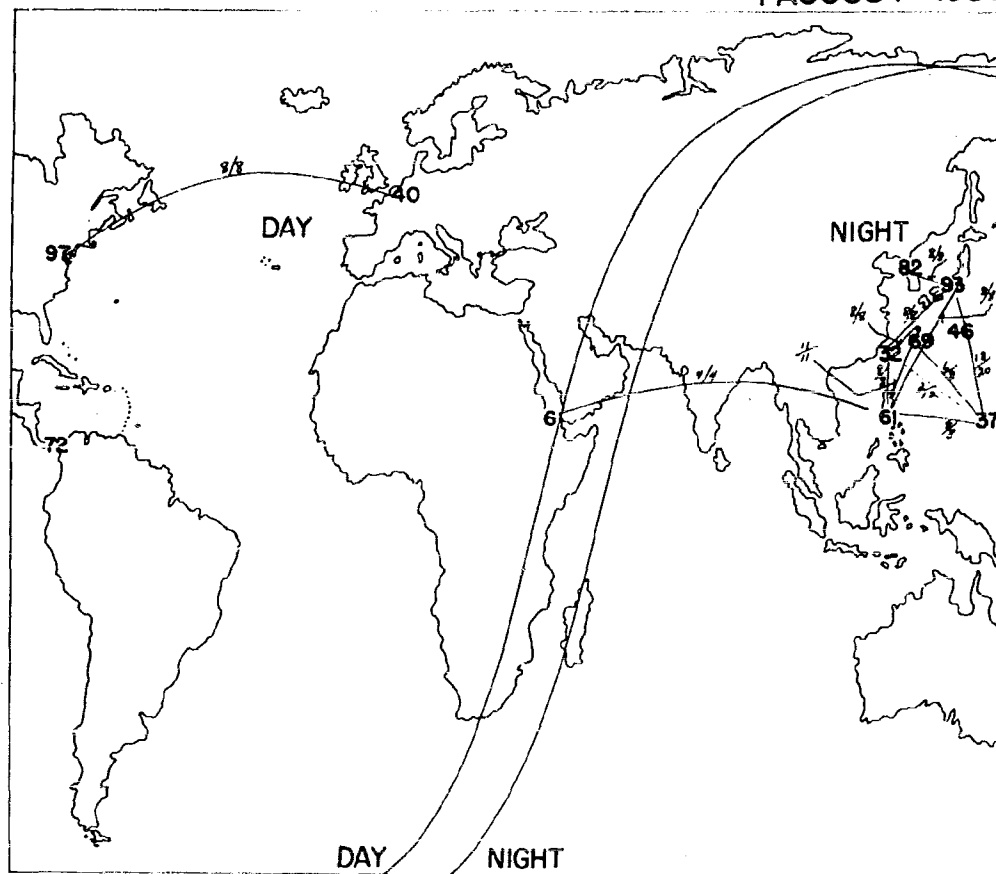
Figure 61a

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1500Z

1 AUGUST 1958

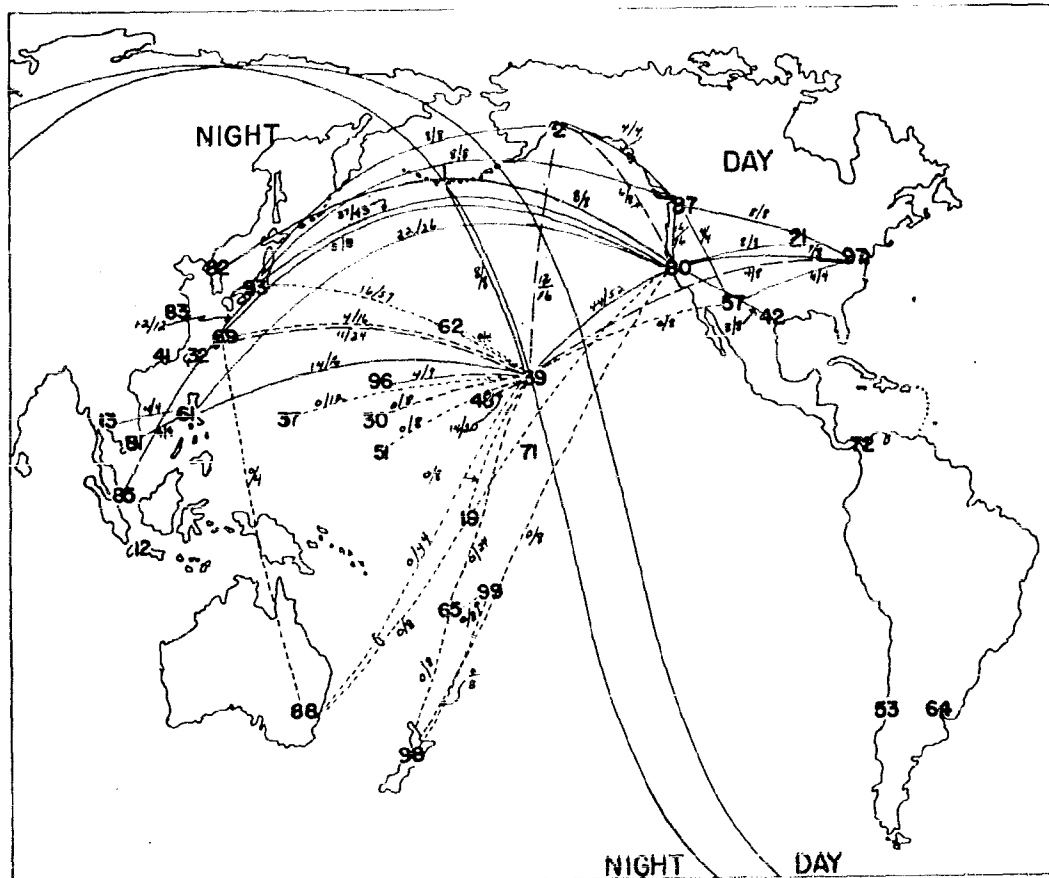


# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1530Z

1 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

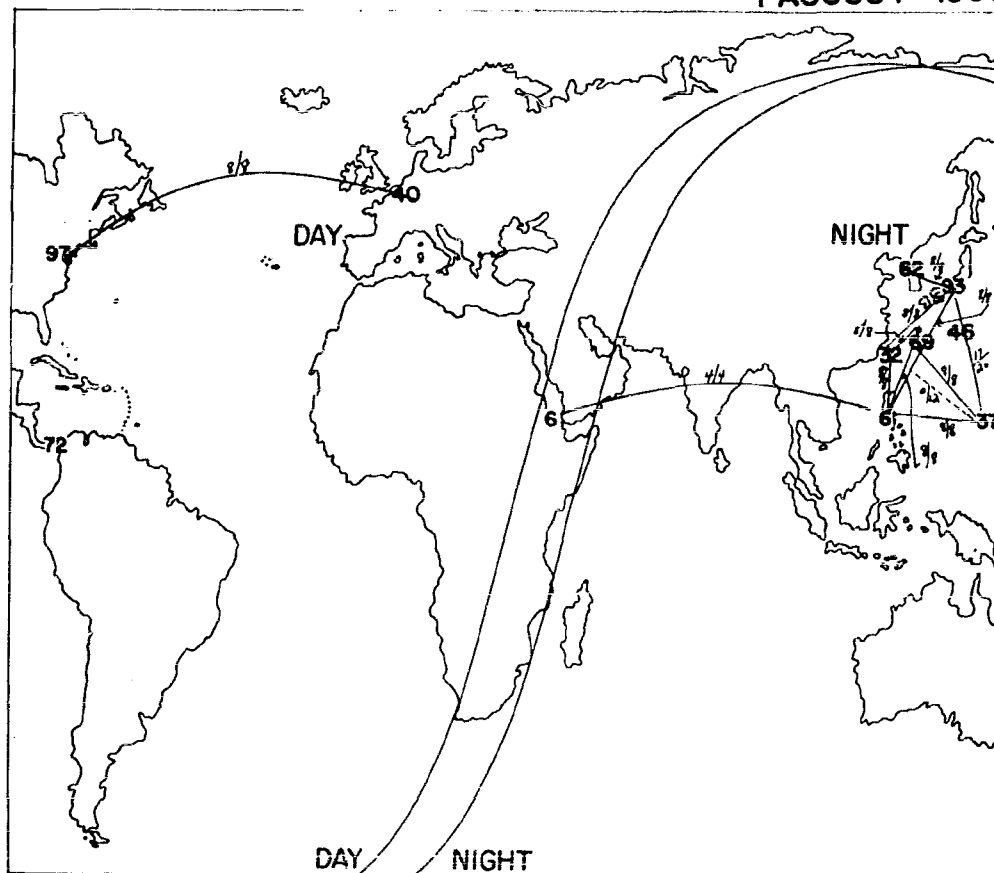
1. ADAK	21. CHICAGO	41. HONGKONG	57. LAY ALAMOG	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NADI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1530Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SAMOA IS.

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -  
 30% to 80% of frequencies tried were useful: \_\_\_\_\_  
 80% to 100% of frequencies tried were useful: \_\_\_\_\_

( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

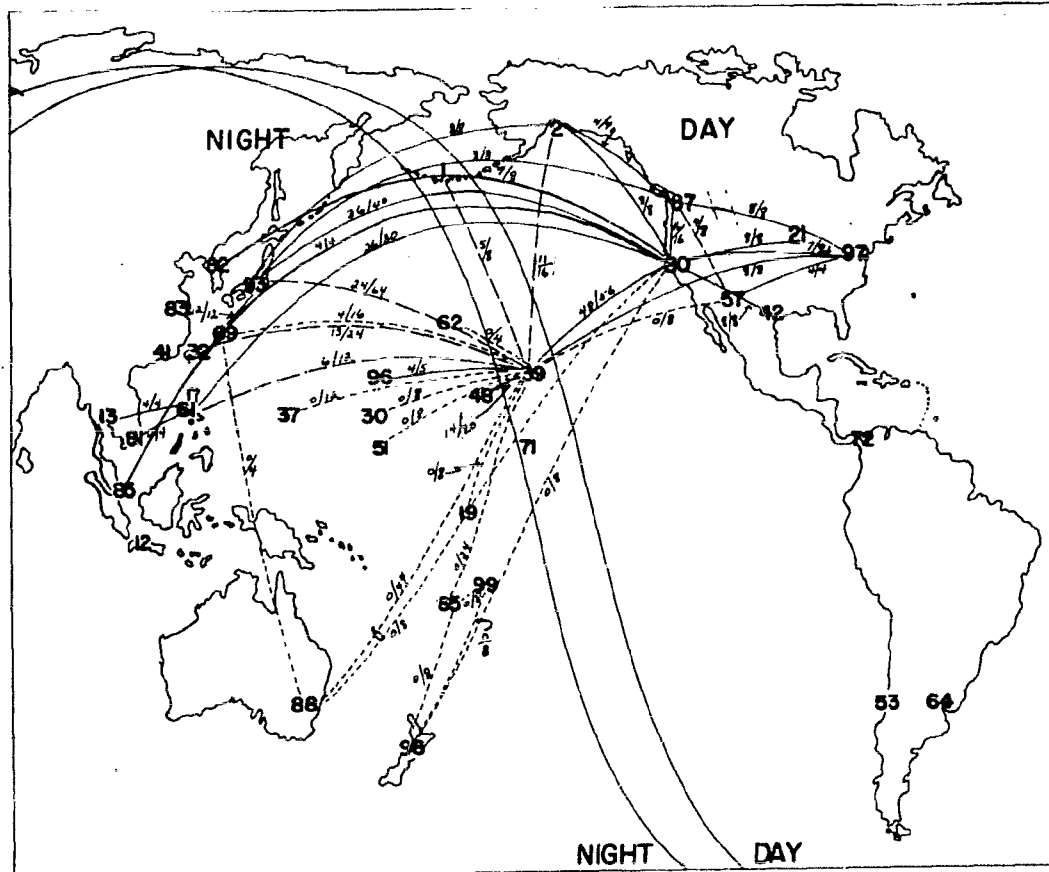
**SECRET**  
 149

Figure 62b

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1600Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

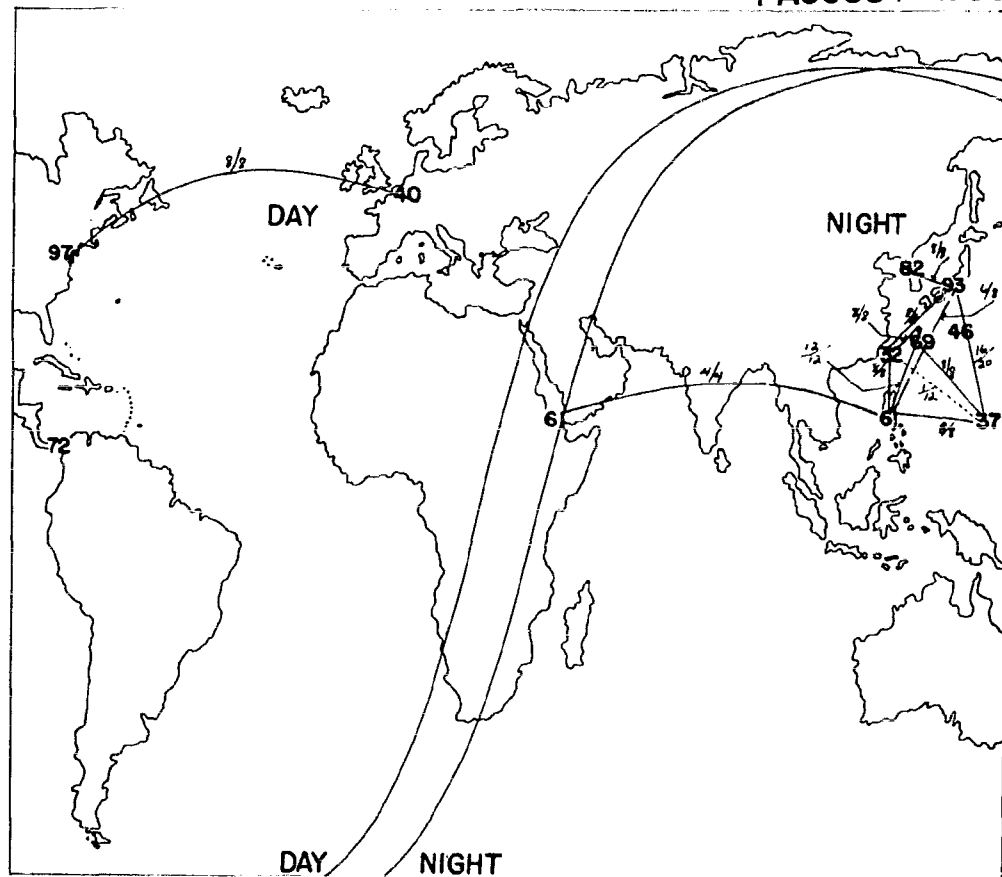
- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAM        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANJUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTGOMERY      | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEOUL          |
| 10. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

**SECRET**

# **SECRET** **SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE** **DURING TIME INTERVAL OF ONE HOUR ALONG** **SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1600Z

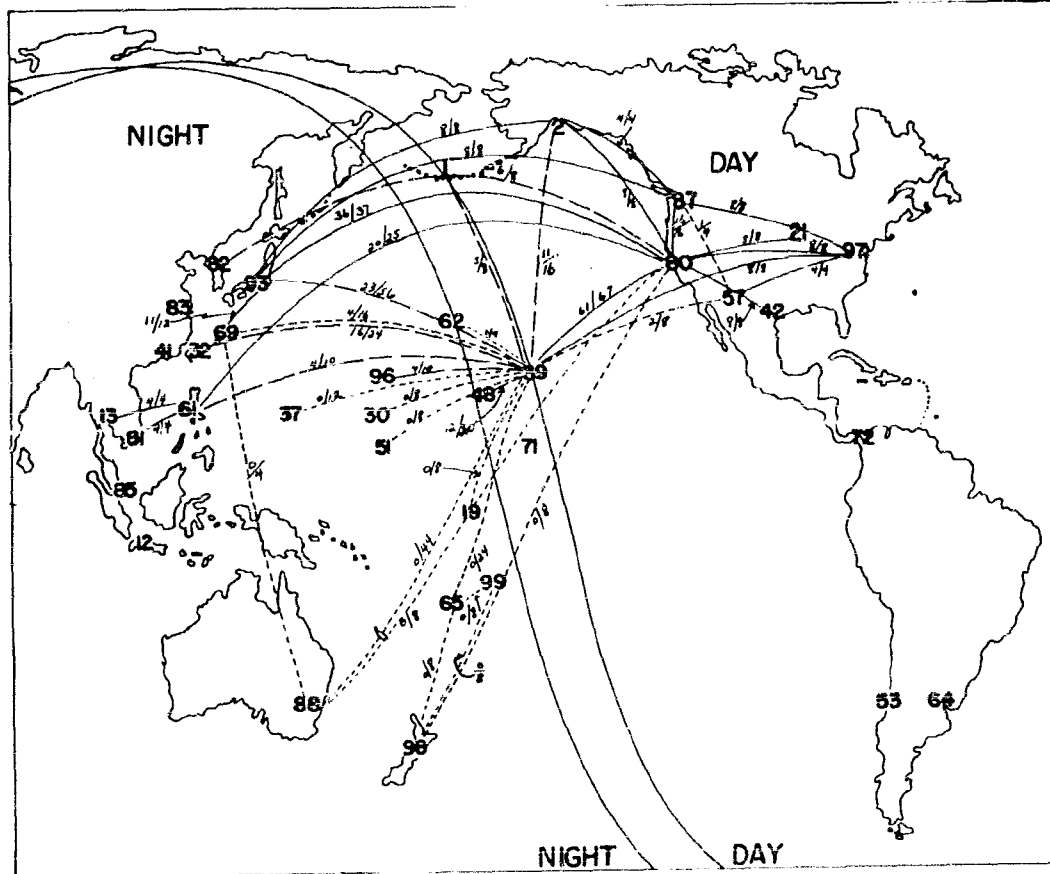
1 AUGUST 1958



**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1630Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

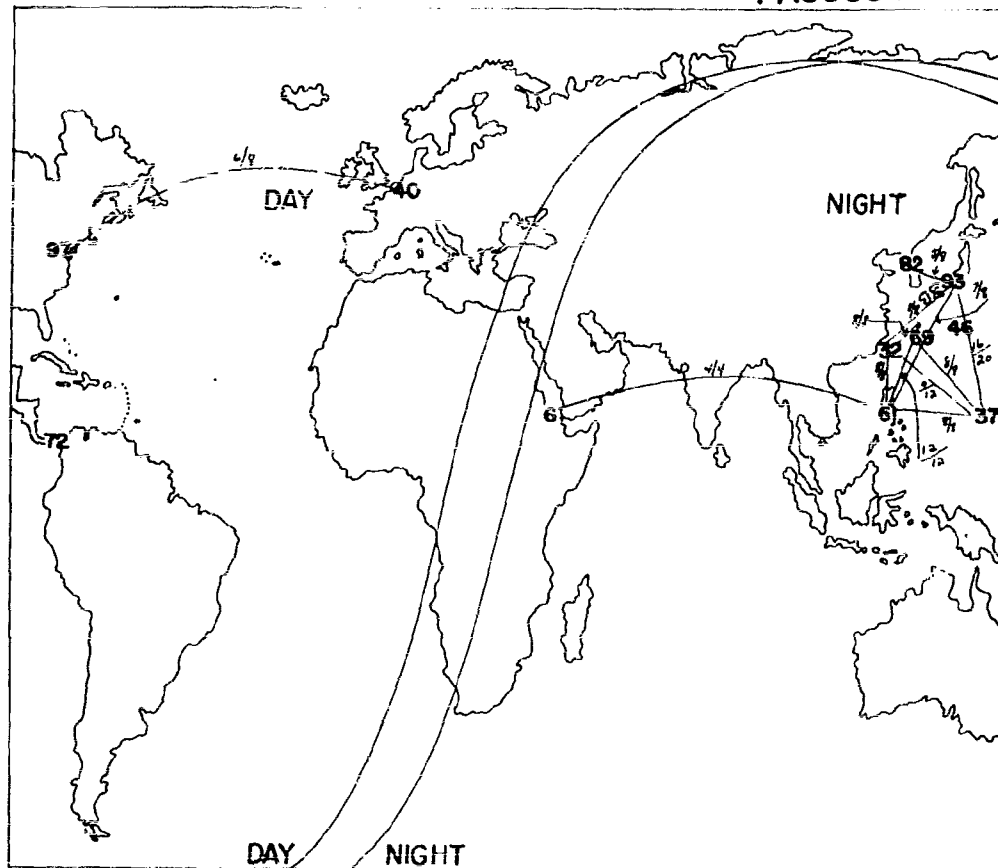
1. ADAK	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANGUM	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1630Z

1 AUGUST 1958



TIME INTERVAL CENTERED ON: 1700Z

[illegible]

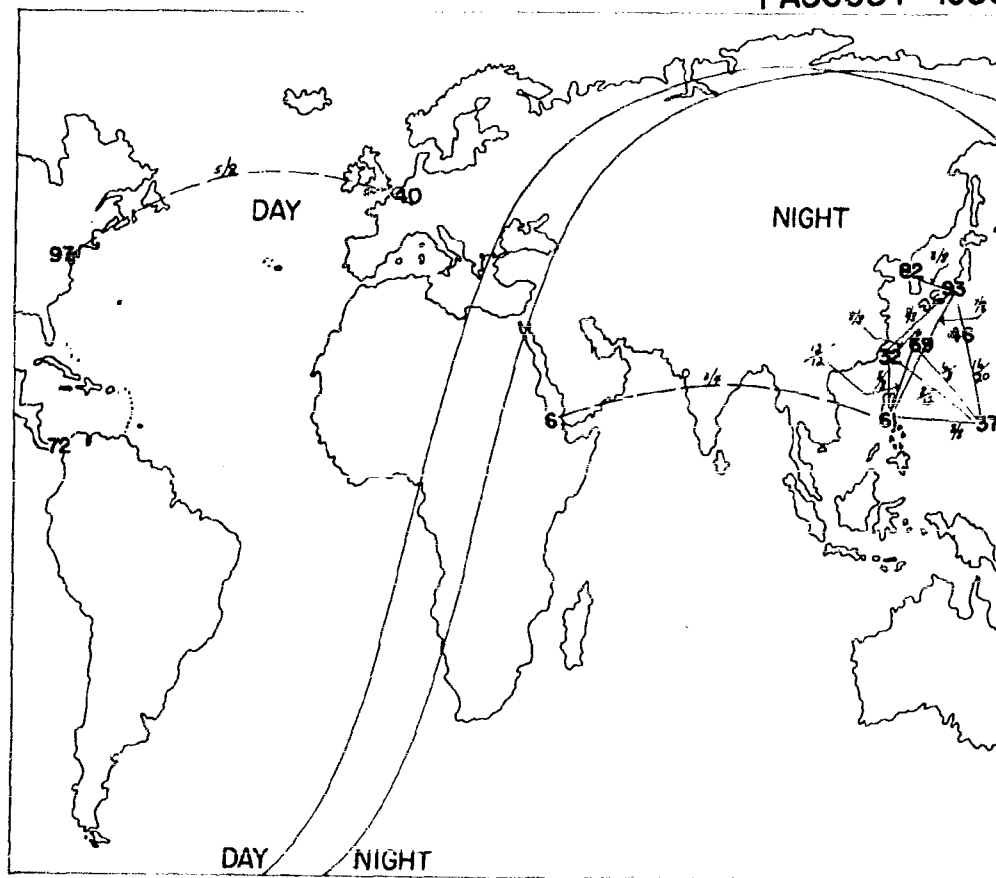
1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ANGELES	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FURUSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BAMBURGO	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

Figure 65a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1700Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

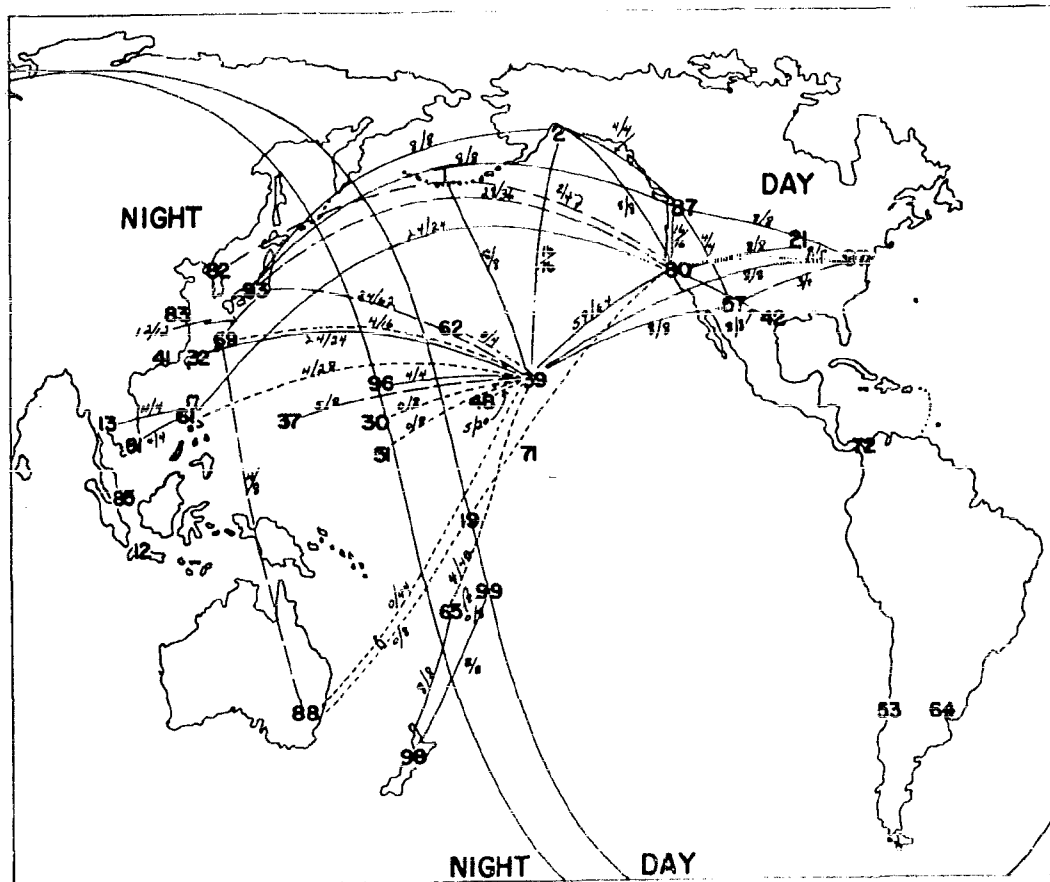
- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————
- ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1800Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

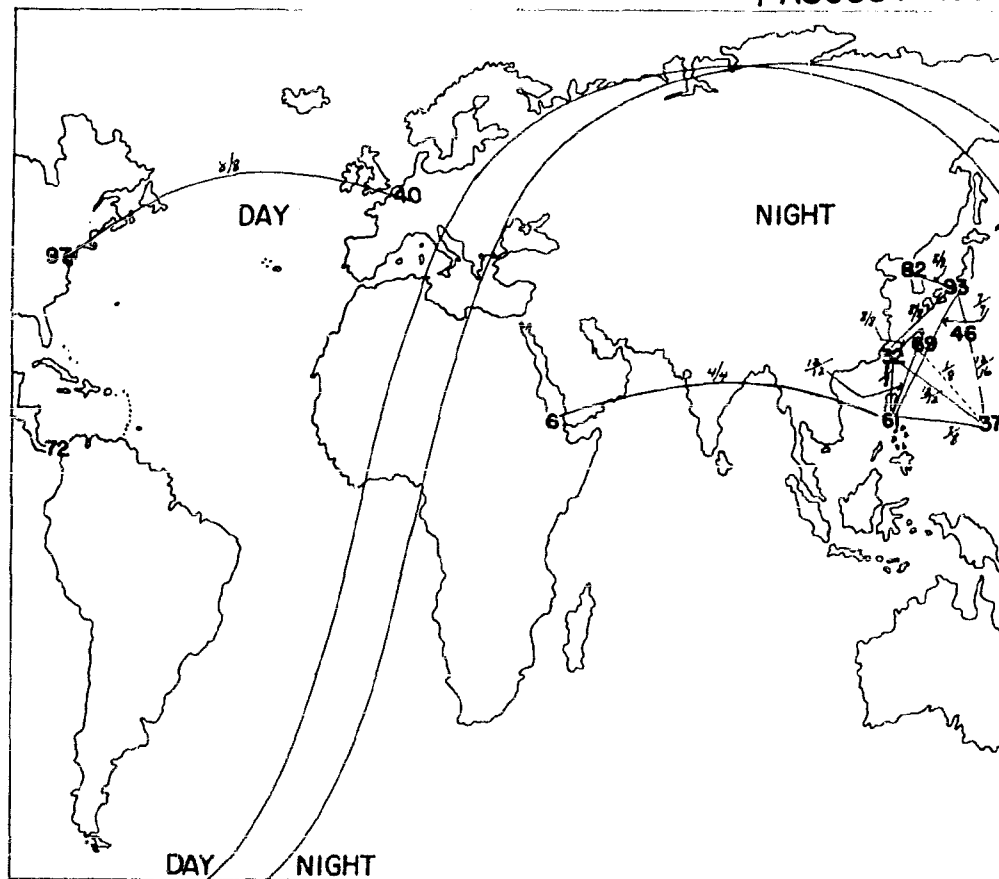
1. ADAK	21. CHICAGO	41. HONOLULU	57. LOS ANGELES	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASHIMA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDAUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANES	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1800Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SAMOA IS.

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -  
 30% to 80% of frequencies tried were useful: — — — — —  
 80% to 100% of frequencies tried were useful: —————

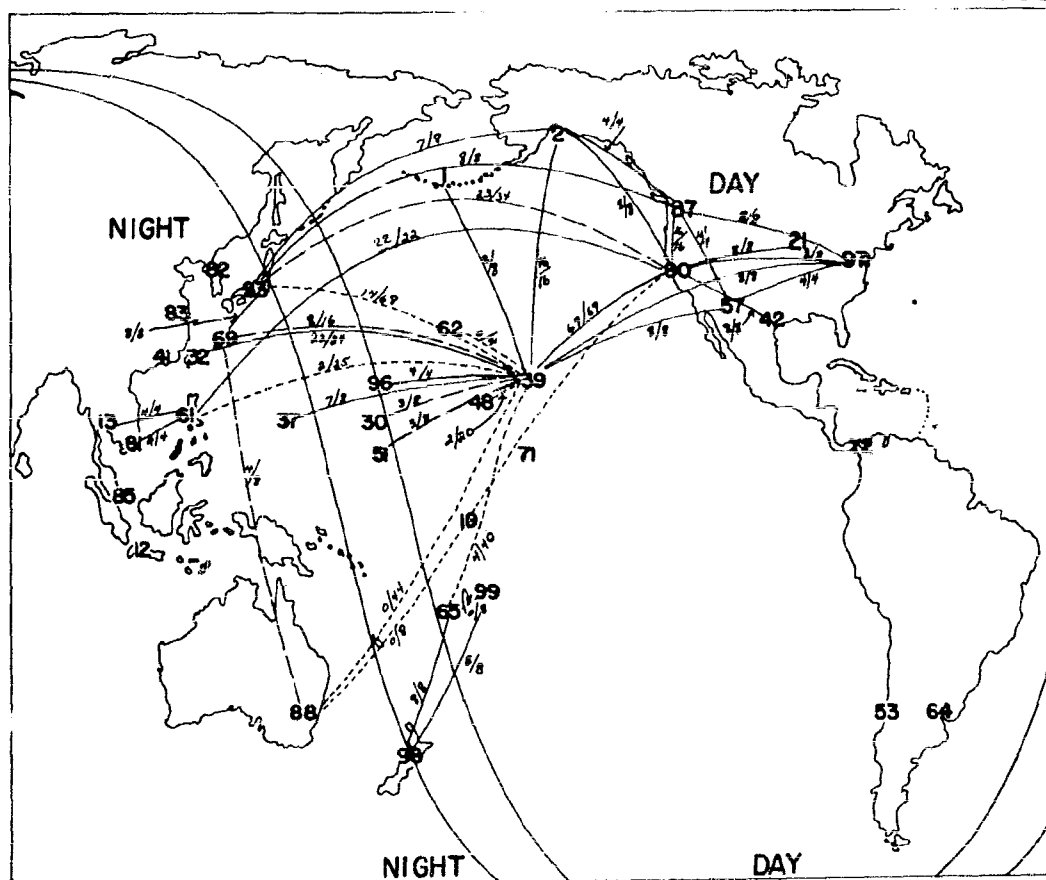
( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1900Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

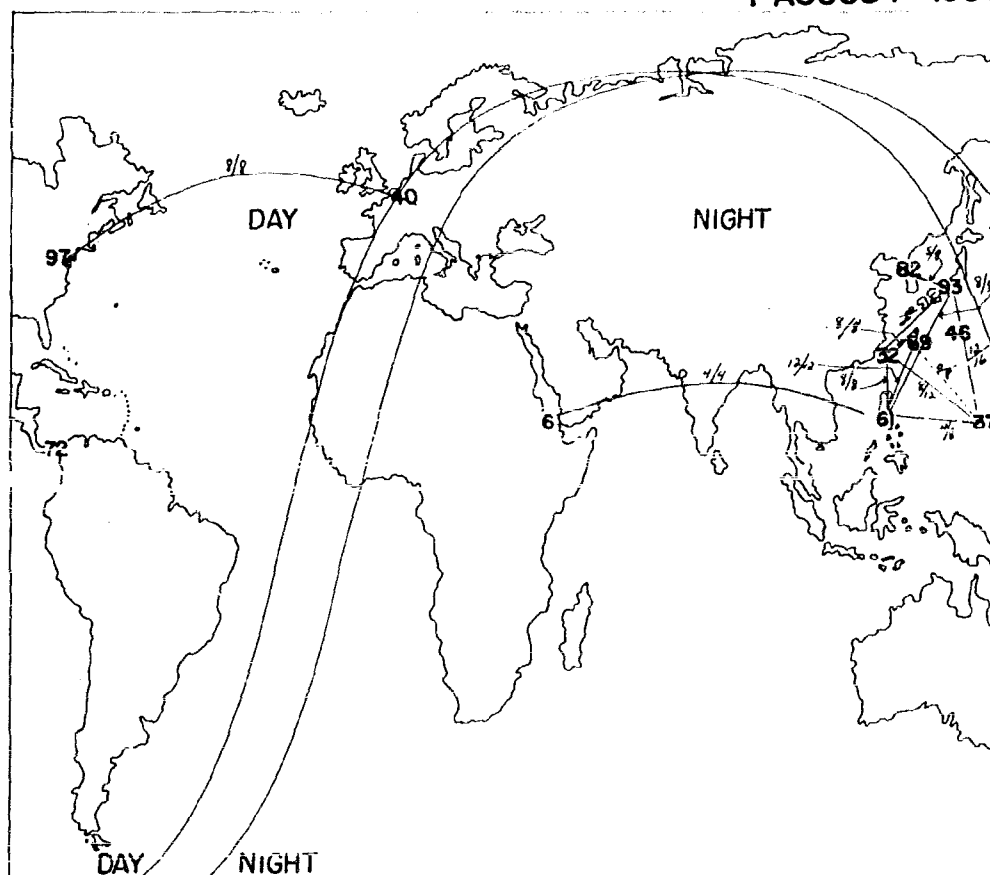
1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWATOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FUKUOKA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICMARDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1900Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————
- ( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

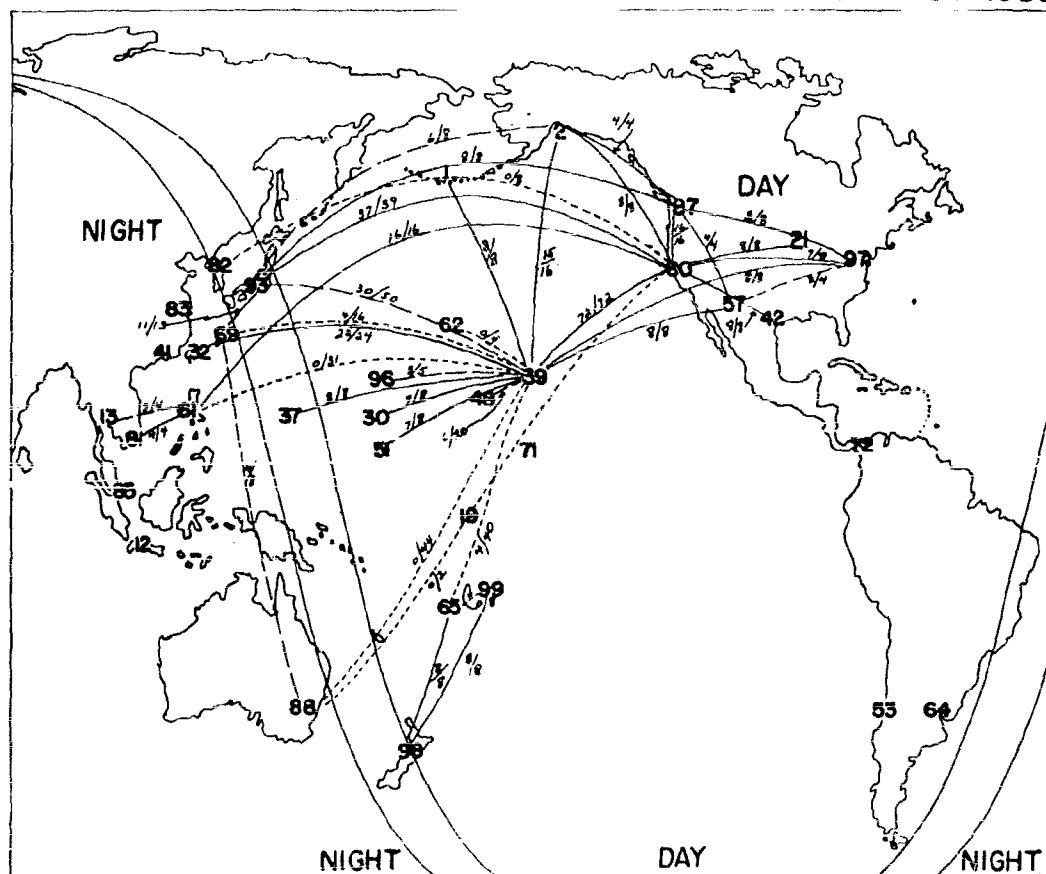
**SECRET**

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 2000Z

1 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LAG ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. TWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICNARIE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTY, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	68. OKINAWA	83. SHANGHAI

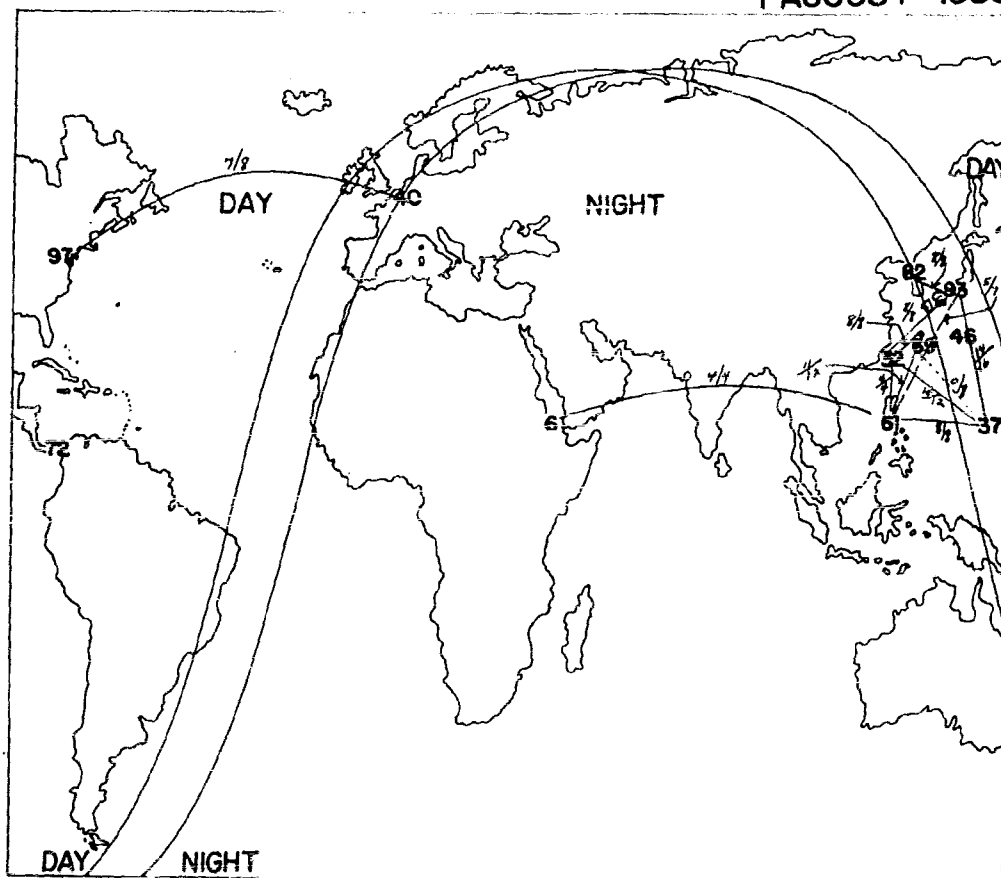
SECRET

Figure 62a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2000Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

89. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SAMOA IS.

**KEY TO FREQUENCY UTILITY**

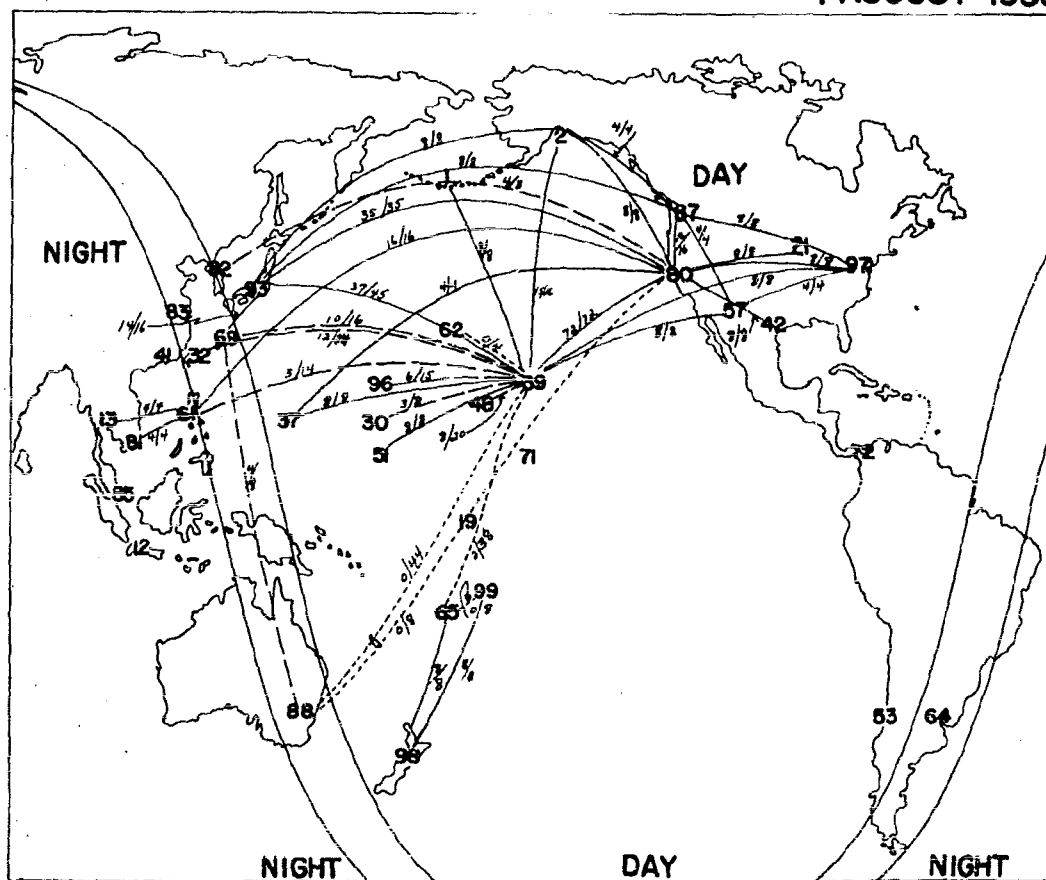
0% to 30% of frequencies tried were useful: - - - - -  
 30% to 80% of frequencies tried were useful: ————  
 80% to 100% of frequencies tried were useful: —————  
 ( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2100Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ANGELES	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

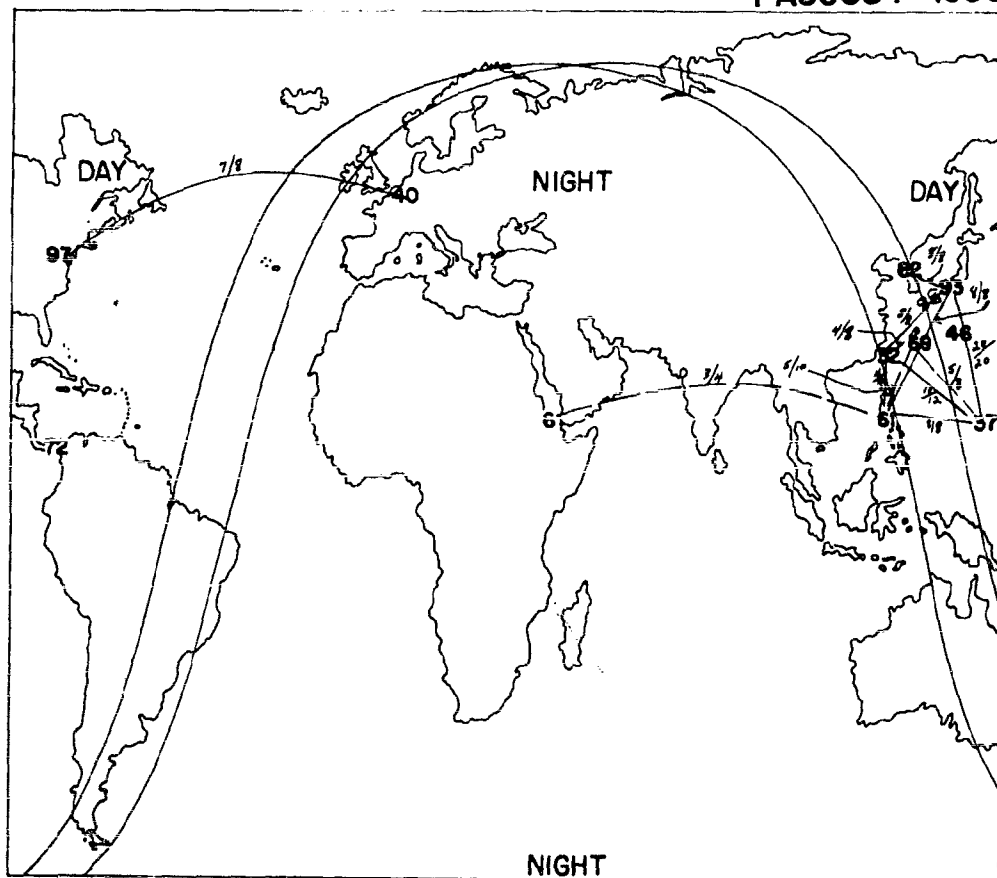
Figure 69a

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2100Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 83. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: -----
- 30% to 80% of frequencies tried were useful: - - - - -
- 80% to 100% of frequencies tried were useful: \_\_\_\_\_

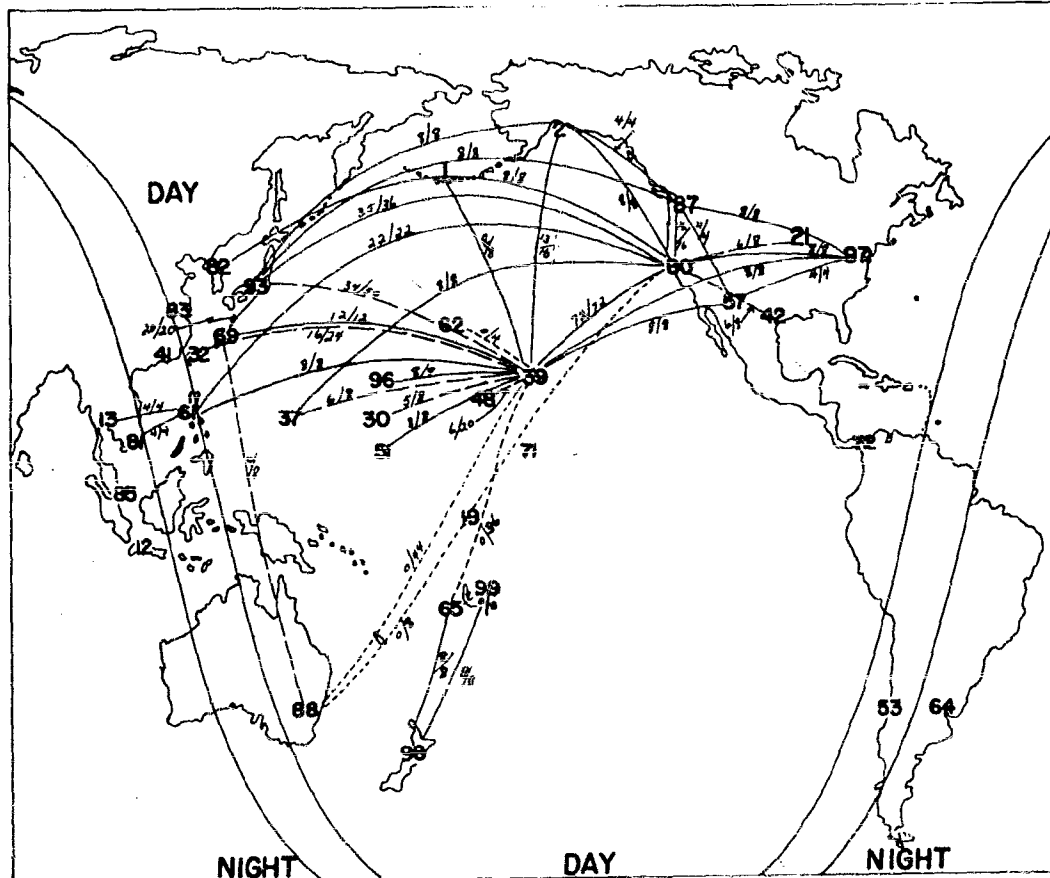
( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2200Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

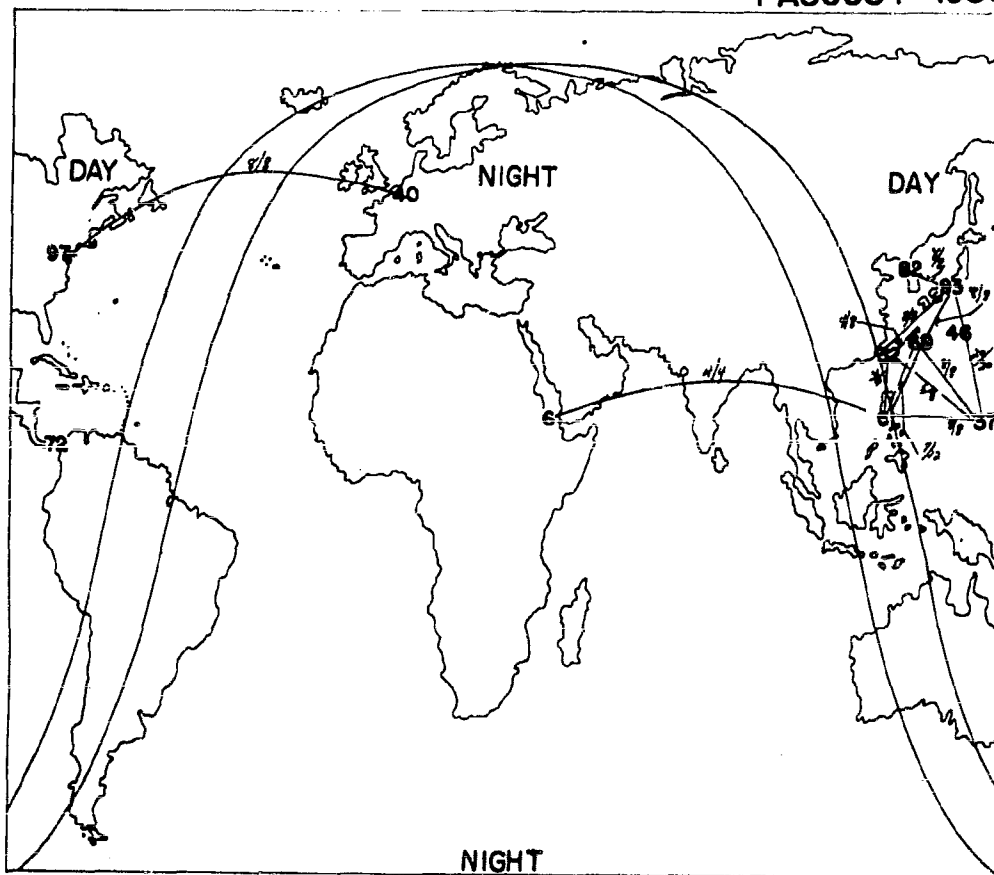
- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAK        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. AFMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTIGRANDE     | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEGUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2200Z

1 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 83. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————

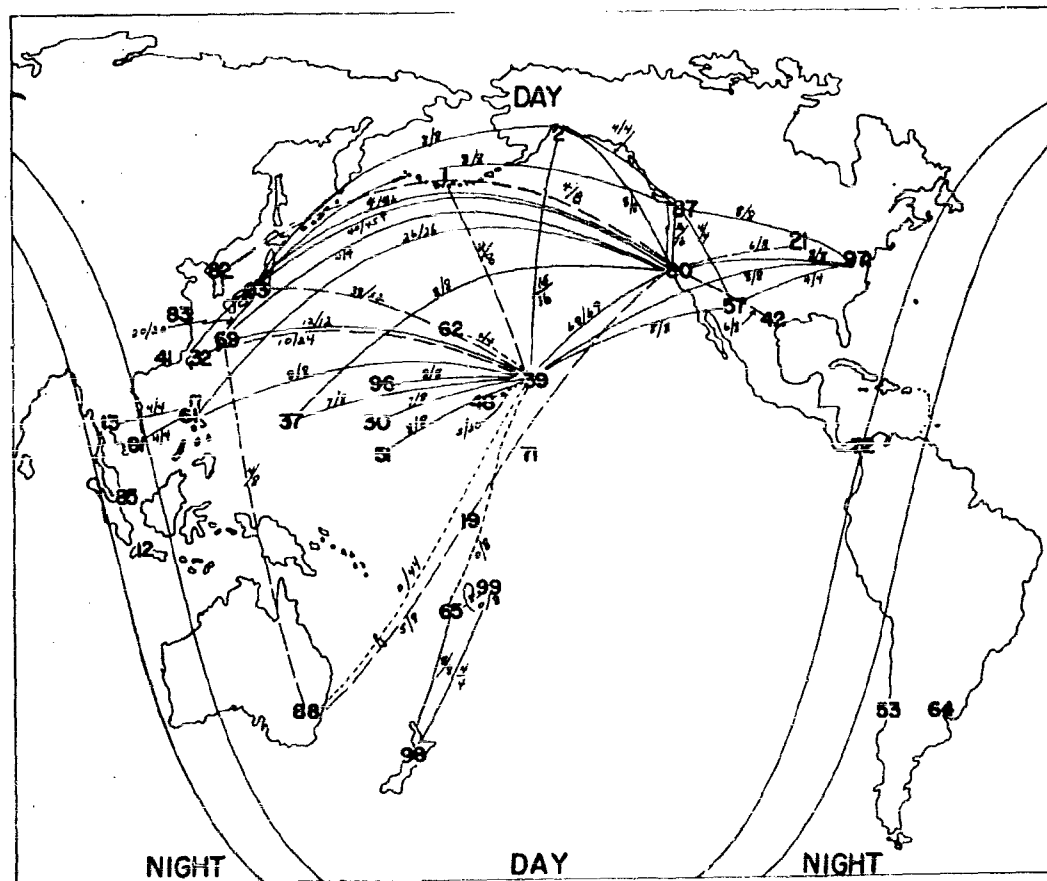
( $\frac{x}{y}$ ) - Numerator of fraction is  $x$  (number of usable frequency hours)  
 Denominator is  $4 \times y$  (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2300Z

1 AUGUST 1958



KEY TO TERMINAL LOCATIONS

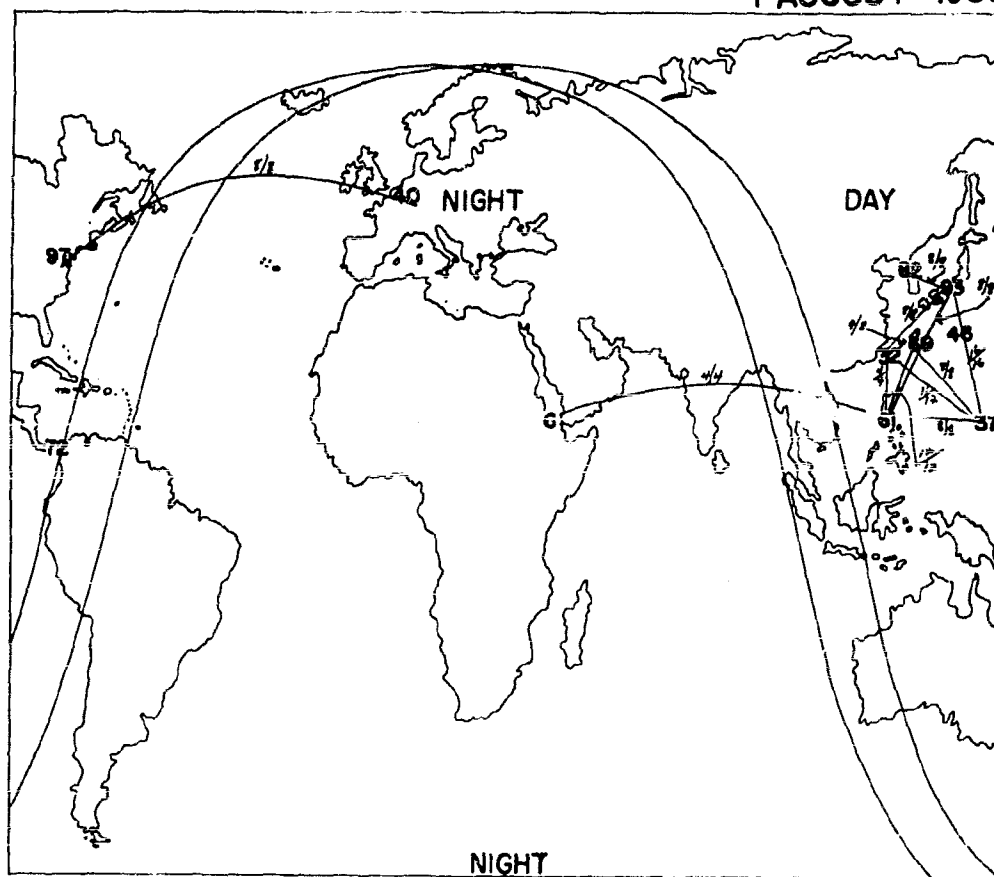
1. ADAK	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMIRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NARDI, FIJI IS.	82. SEIKIL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2300Z

1 AUGUST 1958



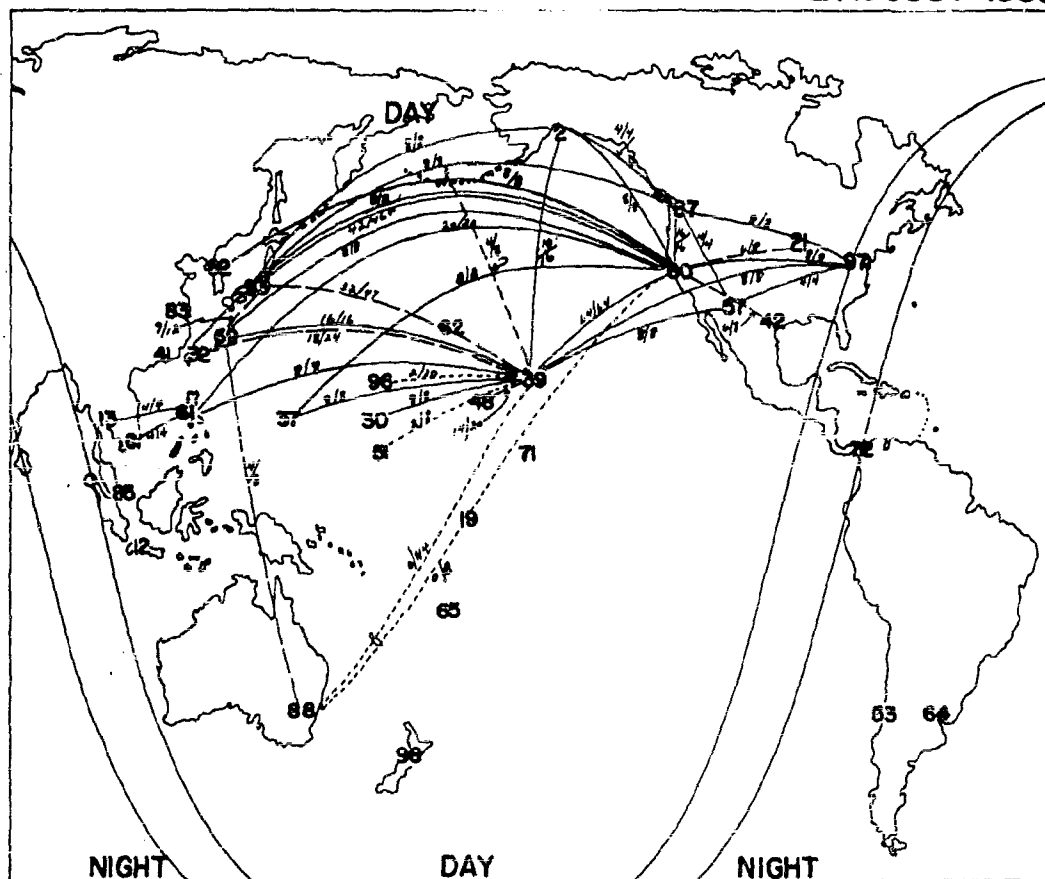
KEY TO TERMINAL LOCATIONS		KEY TO FREQUENCY UTILITY
85. SINGAPORE	96. WAKE IS.	0% to 30% of frequencies tried were useful: - - - - -
87. SEATTLE	97. WASHINGTON, D.C.	30% to 80% of frequencies tried were useful: — — — —
88. SYDNEY	98. WELLINGTON	80% to 100% of frequencies tried were useful: —————
93. TOKYO	99. SAMOA IS.	( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)
		Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0000Z

2 AUGUST 1958



KEY TO TERMINAL LOCATIONS

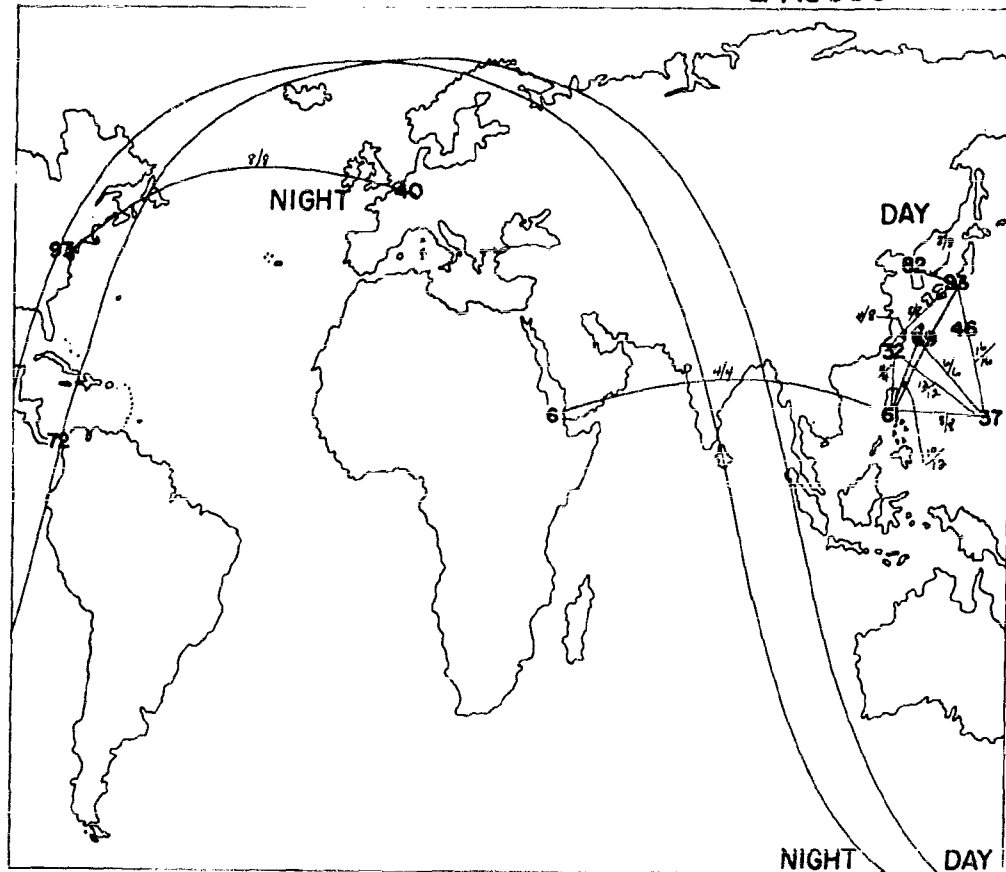
1. ADAM	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0000Z

2 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

# SECRET

Table I

1 August 1958

Z time

Circuits between  
Honolulu and

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1030	1100	1130	1200	1230
Los Alamos	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	4/8
Washington, D. C.	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	6/8	4/8	3/8
San Francisco	54/54	60/60	59/60	56/58	60/61	60/60	56/58	46/51	69/70	72/72	59/59	51/51	43/46	42/46	32/47	36/55
Anchorage	8/8	8/8	8/8	8/8	8/8	7/8	7/8	8/8	8/8	8/8	8/8	8/8	8/8	4/10	4/16	2/16
Adak	2/4	1/8	4/8	7/8	8/8	8/8	8/8	8/8	6/8	2/4	4/8	4/8	8/8	6/8	8/8	8/8
Midway											0/1	0/3	0/4	0/4	0/4	
Tokyo	24/24	31/32	32/32	32/32	33/33	44/44	44/44	44/44	48/50	56/59	68/68	84/84	53/82	33/80	35/80	33/73
Okinawa	12/12	16/16	16/16	13/13	14/14	16/16	16/16	15/16	14/16	16/16	15/16	12/16	10/16	8/16	4/16	4/16
Formosa	2/4	4/8	7/12	12/24	16/24	20/24	20/24	24/24	24/24	24/24	24/24	24/24	24/24	24/24	24/24	21/24
Manila	6/8	7/8	6/8	8/8	8/8	8/8	6/8	8/8	7/8	8/8	8/8	8/8	6/24	7/43	8/44	8/48
Wake Is.											0/6	0/34	0/60	0/54	4/47	
Guan	4/4	6/8	8/8	6/8	8/8	6/6	8/8	8/8	8/8	6/8	6/8	8/8	4/10	0/12	0/14	0/16
Eniwetok	8/8	6/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	7/8	3/8	2/8	0/8	0/8
Kwajalein	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	7/8	7/8	3/8	4/8	0/8	0/8
Johnston Is.	16/16	15/16	20/20	20/20	20/20	20/20	20/20	18/20	20/20	20/20	20/20	7/7	4/4	4/4	4/7	4/16
Sidney											0/1	0/6	0/24	0/37	4/44	
Canton Is.											0/8	0/8	0/8	0/8	0/8	
Nandi, Fiji Is.											0/4	0/12	0/19	0/20	0/20	0/20

Communication Capability for the day of the Peak Nuclear shot of Circuit Paths which have one terminal in Honolulu.

Numerator is in units of quarter-hours of successful circuit communications over a period of one hour.

Denominator is in units of circuit quarter-hours of transmitter radiations over a period of one hour.

Z time is given for center of hourly period.

# SECRET

1 August 1958

Z time

Table I Continued

Circuits between  
Honolulu and

	1300	1330	1400	1430	1500	1530	1600	1630	1700	1800	1900	2000	2100	2200	2300	0000
Los Alamos	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	2/ 8	6/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8
Washington, D. C.	4/ 8	4/ 8	4/ 8	4/ 8	4/ 8	4/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	7/ 8
San Fran- cisco	40/ 52	40/ 51	38/ 48	36/ 48	40/ 47	44/ 52	48/ 56	61/ 67	57/ 60	59/ 64	69/ 69	72/ 72	72/ 72	72/ 72	68/ 69	64/ 64
Anchorage	0/ 16	0/ 16	6/ 16	12/ 16	12/ 16	12/ 16	11/ 16	11/ 16	13/ 16	16/ 16	16/ 16	15/ 16	15/ 16	13/ 16	15/ 16	14/ 16
Adak	5/ 8	7/ 8	8/ 8	7/ 8	7/ 8	8/ 8	5/ 8	5/ 8	8/ 8	8/ 8	3/ 8	8/ 8	8/ 8	8/ 8	4/ 8	4/ 8
Midway	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4	0/ 4
Tokyo	32/ 82	31/ 82	30/ 83	28/ 86	24/ 71	16/ 57	24/ 64	23/ 56	21/ 57	24/ 62	14/ 68	30/ 70	37/ 45	34/ 50	38/ 52	32/ 47
Okinawa	4/ 11	4/ 13	4/ 10	4/ 16	4/ 16	4/ 16	4/ 16	4/ 16	4/ 16	8/ 16	4/ 16	10/ 16	12/ 16	12/ 12	12/ 12	16/ 16
Formosa	16/ 24	10/ 24	14/ 24	11/ 24	12/ 24	11/ 24	13/ 24	16/ 24	23/ 24	24/ 24	22/ 24	23/ 24	12/ 24	16/ 24	10/ 24	18/ 24
Manila	7/ 50	10/ 43	6/ 36	6/ 19	13/ 16	14/ 16	6/ 12	4/ 10	3/ 15	4/ 28	2/ 25	0/ 31	5/ 14	8/ 8	8/ 8	8/ 8
Wake Is.	5/ 25	5/ 11	4/ 14	4/ 18	4/ 16	4/ 9	4/ 5	4/ 10	2/ 12	4/ 4	4/ 4	3/ 5	6/ 15	8/ 9	8/ 8	2/ 20
Guam	0/ 18	0/ 16	0/ 16	0/ 16	0/ 13	0/ 12	0/ 12	0/ 12	2/ 12	5/ 8	7/ 8	8/ 8	8/ 8	6/ 8	7/ 8	8/ 8
Eniwetok	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	3/ 8	7/ 8	3/ 8	5/ 8	7/ 8	8/ 8	8/ 8
Kwajalein	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	3/ 8	7/ 8	8/ 8	8/ 8	8/ 8	8/ 8	2/ 8
Johnston Is.	4/ 20	4/ 20	6/ 20	10/ 20	12/ 20	14/ 20	14/ 20	12/ 20	12/ 20	5/ 20	2/ 20	6/ 20	8/ 20	6/ 20	5/ 20	14/ 20
Sidney	10/ 44	4/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44	0/ 44
Canton Is.	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8							
Nandi, Fiji Is.	0/ 28	0/ 32	0/ 28	0/ 24	0/ 24	0/ 24	0/ 24	0/ 24	0/ 32	4/ 40	4/ 40	4/ 40	2/ 38	0/ 36	0/ 8	

# SECRET

Table II

1 August 1958

Z time

Circuits between  
San Francisco and

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1030	1100	1130	1200	1230
Ft San Houston	8/8	8/8	6/8	6/8	8/8	8/8	8/8	6/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8
Washington	8/8	8/8	8/8	8/8	8/8	8/8	7/8	7/8	8/8	4/4	4/4	6/6	8/8	8/8	7/8	7/8
Chicago	8/8	6/8	8/8	8/8	8/8	8/8	8/8	7/8	6/8	4/8	4/8	4/3	4/8	4/8	4/8	4/8
Seattle	16/16	16/16	16/16	16/16	16/16	16/16	16/16	4/4	4/4	4/4	16/16	16/16	16/16	16/16	16/16	16/16
Anchorage	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	7/8	5/8	5/8
Korea	4/8	4/8	8/8	8/8	8/8	8/8	8/8	6/8	6/8	8/8	8/8	8/8	8/8	6/8	5/8	4/8
Hongkong	0/8	0/8	6/8	8/8	8/8	8/8					4/8	6/8	8/8	8/8	6/8	3/8
Formosa	8/8	8/8	8/8	4/4						6/6	8/8	6/6	6/8	6/8	2/6	0/6
Tokyo	24/40	31/37	34/38	40/40	40/40	40/40	40/40	39/39	29/31	42/42	44/44	45/45	40/42	35/43	36/45	29/45
Okinawa	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	6/8	4/8	2/4
Manila	10/10	12/12	9/12	11/12	12/12	12/12	12/12	12/12	14/14	20/20	19/19	20/20	18/22	17/25	20/34	18/36
Bandung															4/4	6/8
Guam	8/8	8/8	5/7	6/8	6/7	8/8	8/8	5/7	8/8	8/8	8/8	8/8	4/7	2/5	2/8	0/10
Sidney	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	3/9	0/14	0/19	0/20
Singapore																
Wellington			4/4	8/8	8/8	4/4										

Communication Capability for the day of the Teak nuclear shot of Circuit Paths which have one terminal in San Francisco.

Numerator is in units of quarter-hours of successful circuit communications over a period of one hour.

Denominator is in units of circuit quarter-hours of transmitter radiations over a period of one hour.

Z time is given for center of hourly period.

# SECRET

1 August 1958

Table II Continued  
Circuits between  
San Francisco and

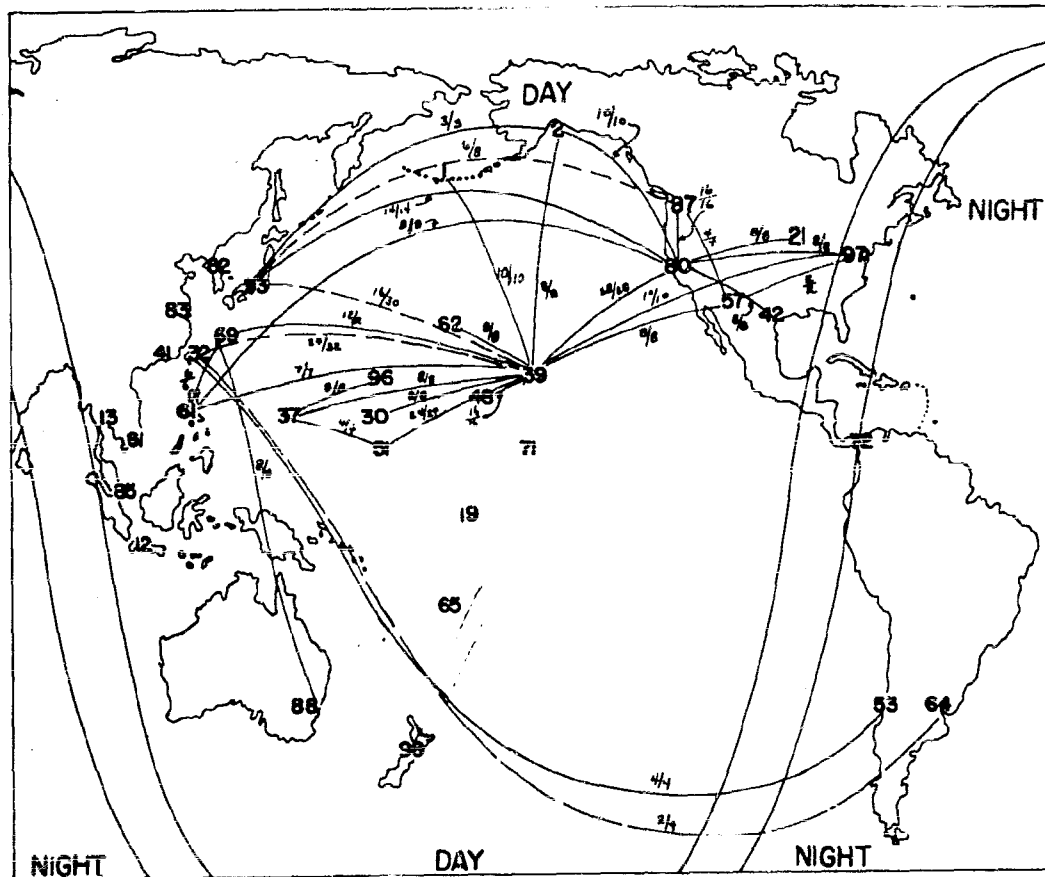
Z time

	1300	1330	1400	1430	1500	1530	1600	1630	1700	1800	1900	2000	2100	2200	2300	0000
Ft. San Houston	8/8	8/8	8/8	6/8	6/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	6/8	6/8	6/8
Washington, D. C.	8/8	8/8	8/8	8/8	8/8	7/8	7/8	8/8	8/8	8/8	8/8	7/8	8/8	8/8	8/8	8/8
Chicago	4/8	4/8	6/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	6/8	6/8	6/8
Seattle	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16
Anchorage	7/8	8/8	8/8	6/8	4/8	6/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8
Korea	0/8	0/8	0/8	0/8	8/8	8/8	7/8	6/8	4/8	2/4		0/8	4/8	8/8	4/8	8/8
Hongkong	5/8	8/8	7/7													
Formosa	0/8	0/8	0/6	0/2											4/4	8/8
Tokyo	24/44	28/42	32/44	36/45	40/44	37/43	36/40	36/37	39/41	28/36	23/34	37/39	35/35	35/36	40/45	42/46
Osaka		4/4	8/8	8/8	8/8	4/4									4/4	8/8
Manila	12/32	12/30	16/30	16/26	20/27	22/26	26/30	20/25	20/24	24/24	22/22	16/16	16/16	22/22	26/26	20/20
Bandung	4/8	6/8	8/8	4/4												
Guam	0/6	0/4	0/2										4/4	8/8	8/8	8/8
Sidney	0/20	0/18	0/14	0/10	0/8	0/8	0/8	0/8	0/8	0/8	0/8	0/2	0/8	0/8	5/4	0/8
Singapore		2/2	6/6	8/8	8/8	8/8	4/4									
Wellington					0/4	0/8	0/8	0/8	0/4							

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0000Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAX        | 21. CHICAGO    | 41. HONOLULU         | 57. LOS ANGELES     | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTIGRANDE     | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

**SECRET**

Figure 73a

TIME INTERVAL CENTERED ON: 0000Z

[illegible]

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	

0% to 30% of frequencies tried were useful: -----  
30% to 60% of frequencies tried were useful: -----  
60% to 100% of frequencies tried were useful: -----

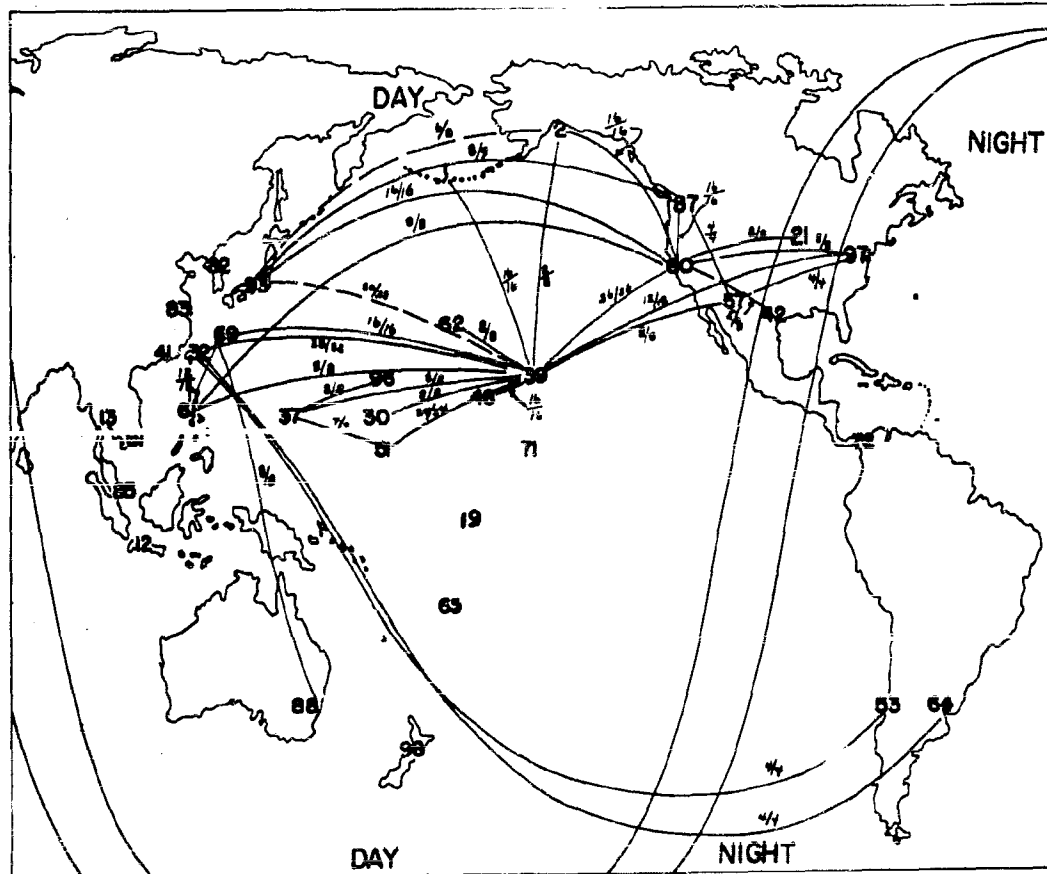
( ) - Numerator of fraction is 4 x (number of usable frequency hours).  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0100Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

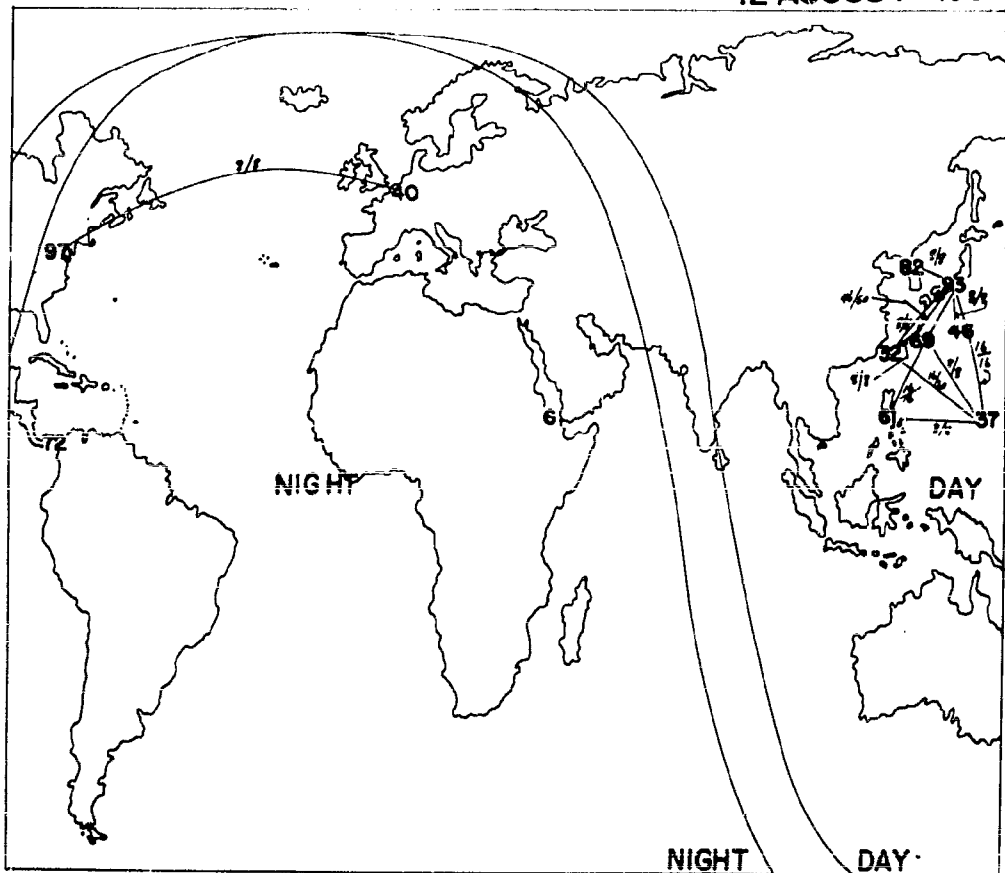
1. ADAM	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0100Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

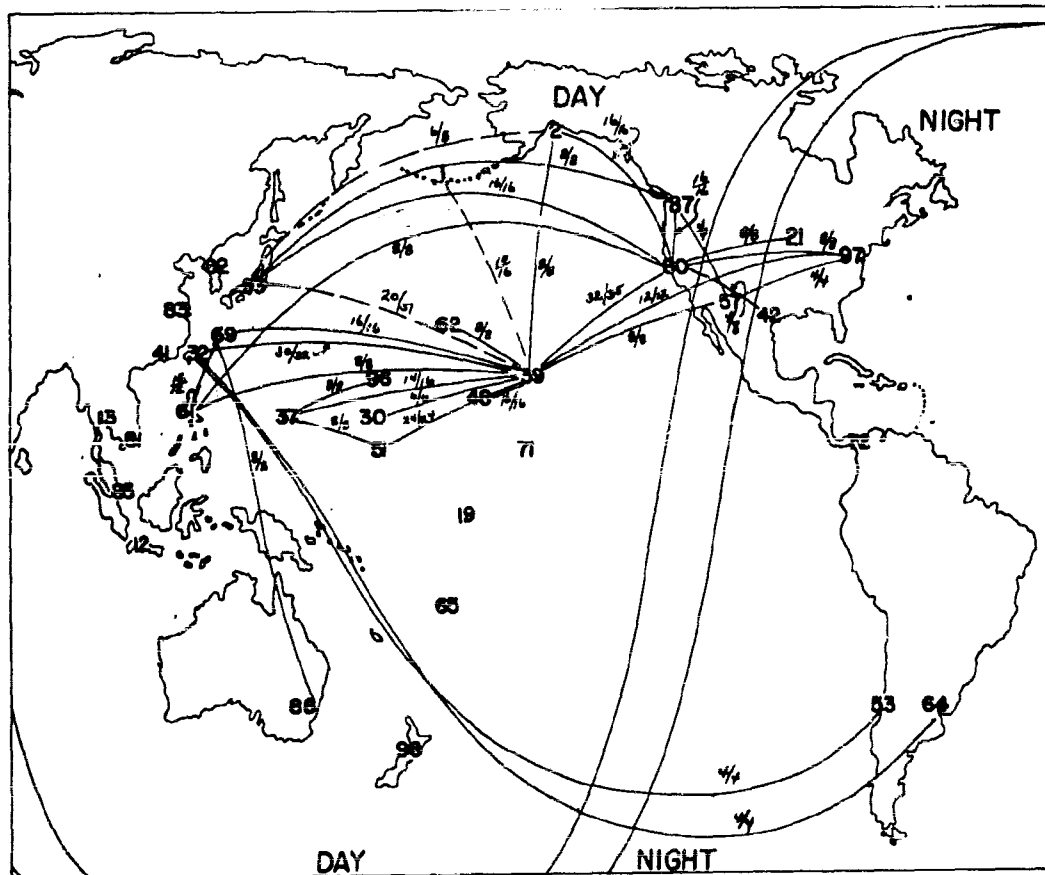
( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0200Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

TIME INTERVAL CENTERED ON: 0200Z

85. SINGAPORE                      96. WAKE IS.  
87. SEATTLE                        97. WASHINGTON, D.C.  
88. SYDNEY                         98. WELLINGTON  
93. TOKYO

0% to 30% of frequencies tried were useful: -----  
30% to 50% of frequencies tried were useful: -----  
50% to 70% of frequencies tried were useful: -----  
70% to 90% of frequencies tried were useful: -----  
90% to 100% of frequencies tried were useful: -----

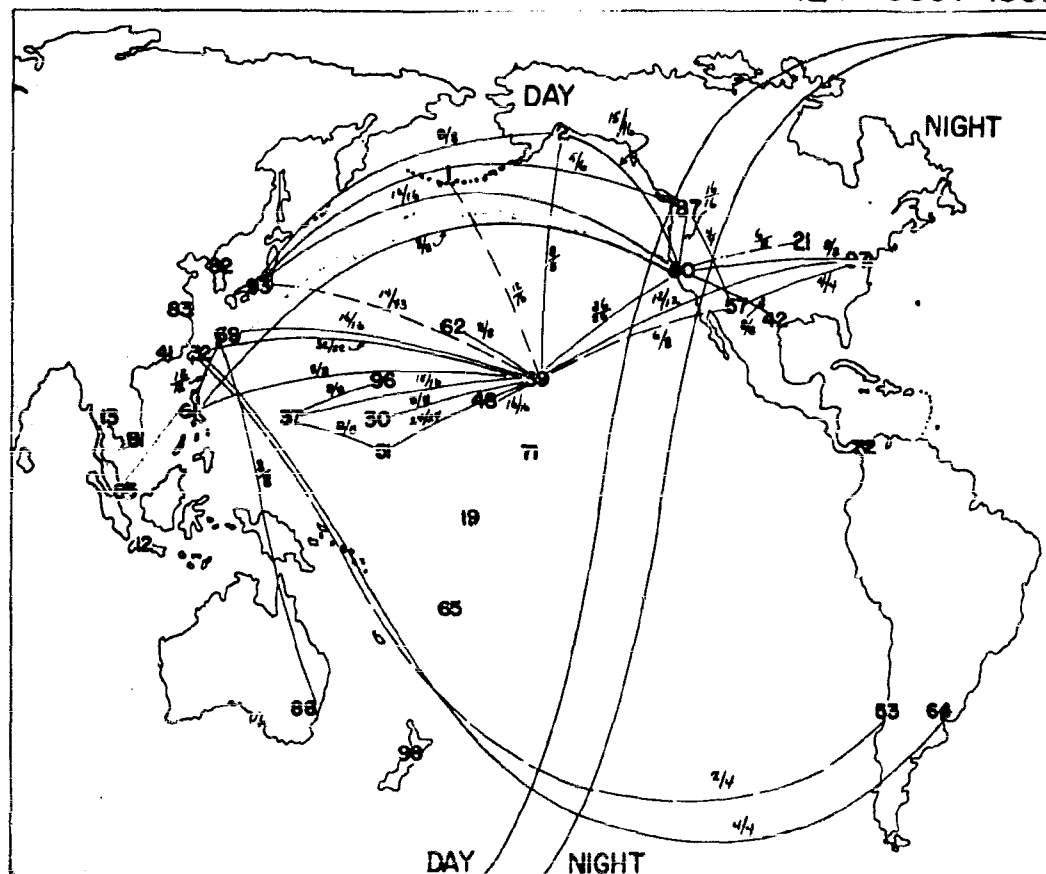
( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0300Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAK        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTIGRANDE     | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

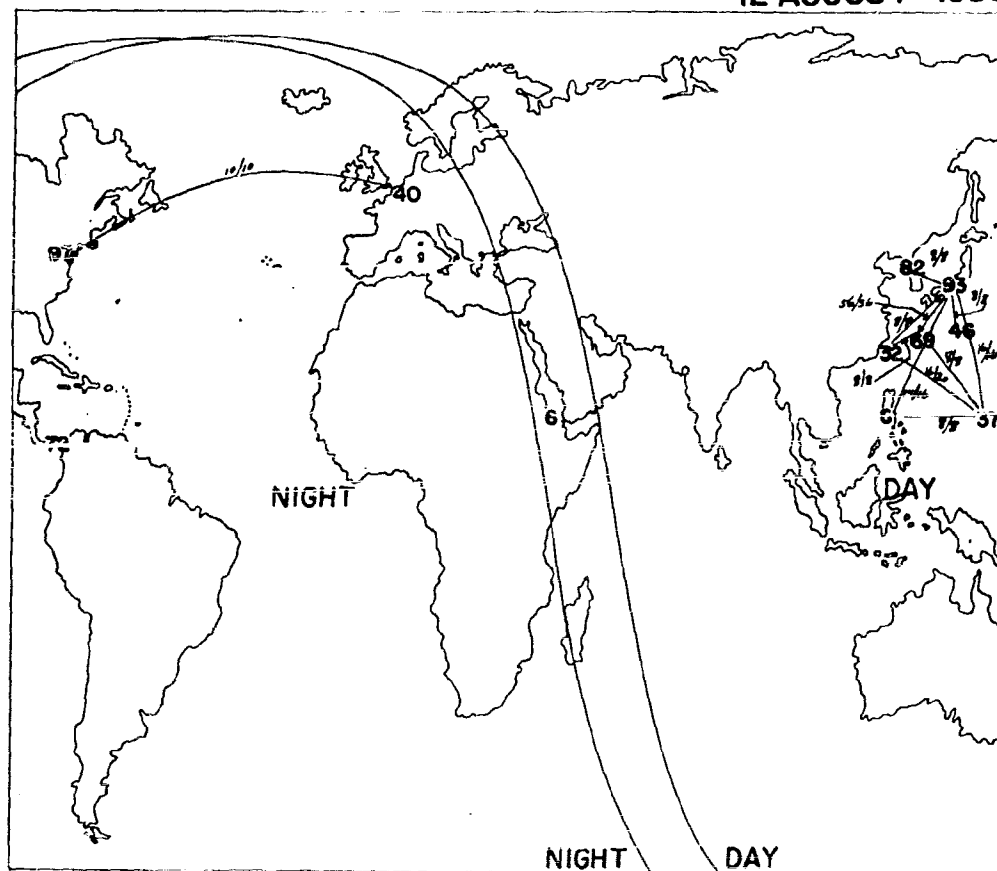
**SECRET**

Figure 76a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0300Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

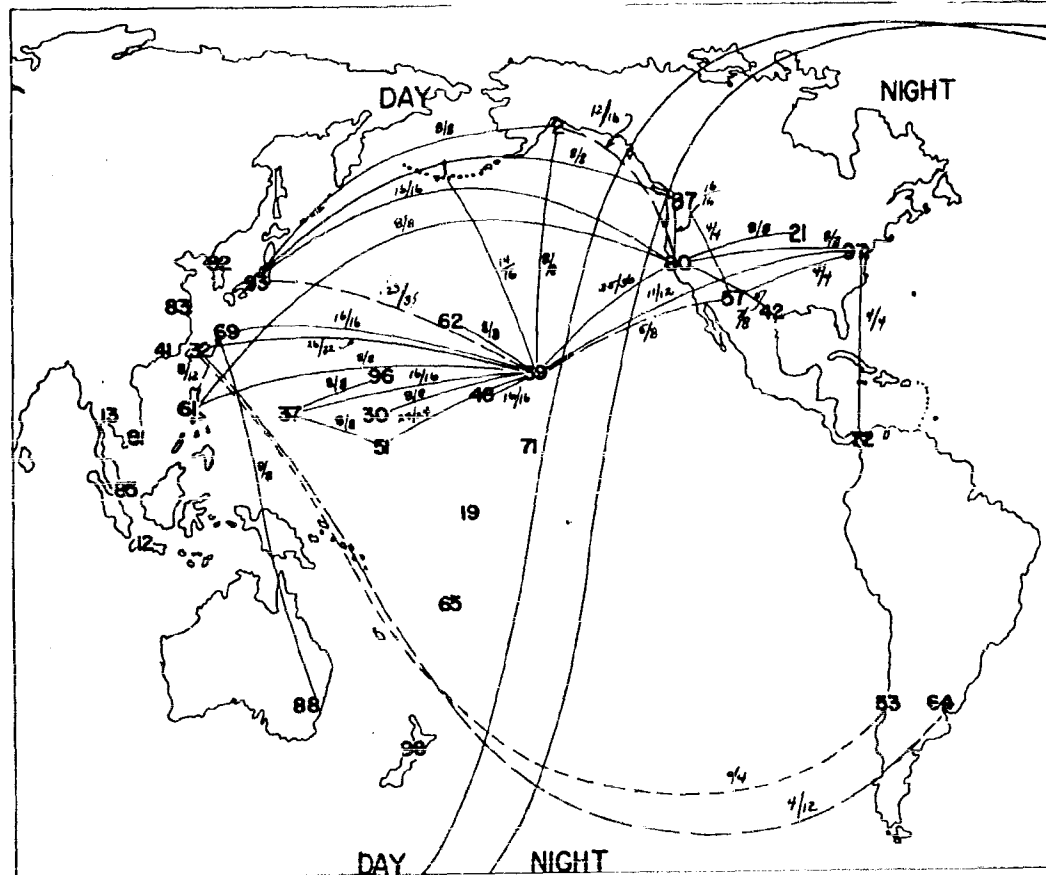
( $\frac{x}{y}$ ) - Numerator of fraction is  $4 \times$  (number of usable frequency hours)  
 Denominator is  $4 \times$  (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: **0400Z**

**12 AUGUST 1958**



KEY TO TERMINAL LOCATIONS:

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NADI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

Figure 77a

TIME INTERVAL CENTERED ON: 0400Z

0% to 30% of frequencies tried were useful: -----  
30% to 80% of frequencies tried were useful: -----  
80% to 100% of frequencies tried were useful: -----

( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

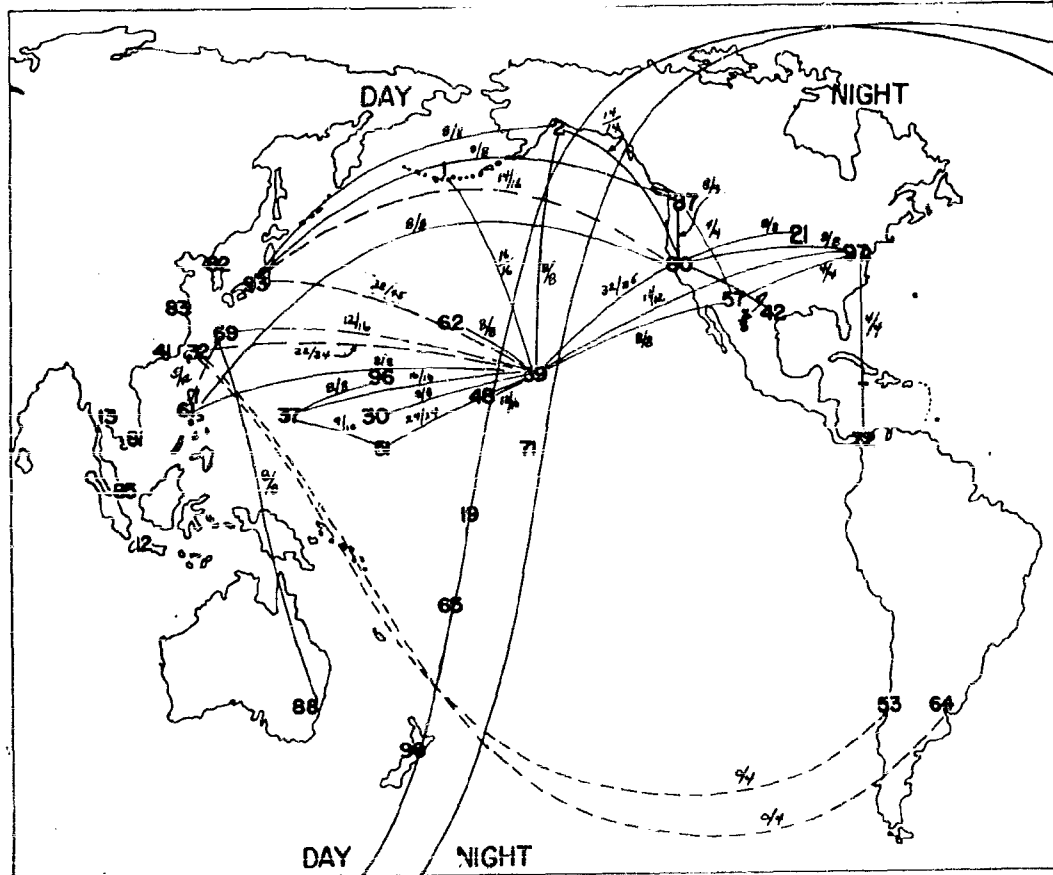
183

Figure 77b

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0500Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

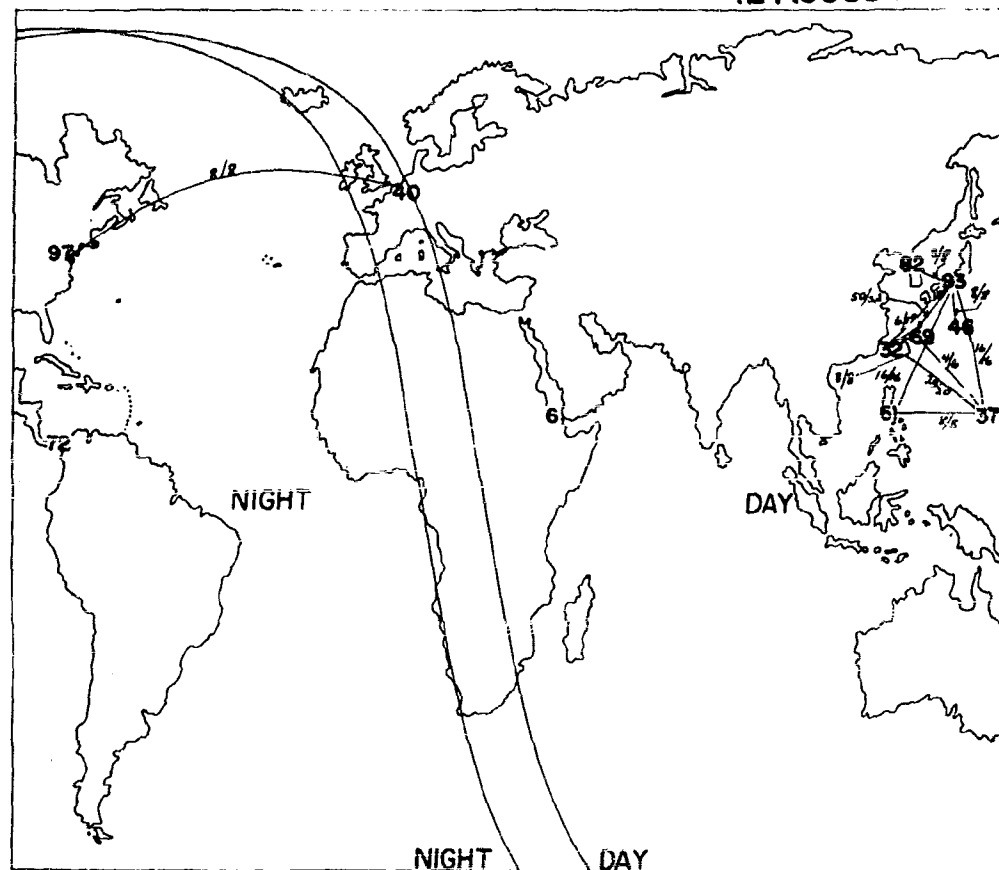
1. ADAK	21. CHICAGO	41. HONKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0500Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: — — — — —

80% to 100% of frequencies tried were useful: —————

( ) - Numerator of fraction is 4 x (number of usable frequency hours)

Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

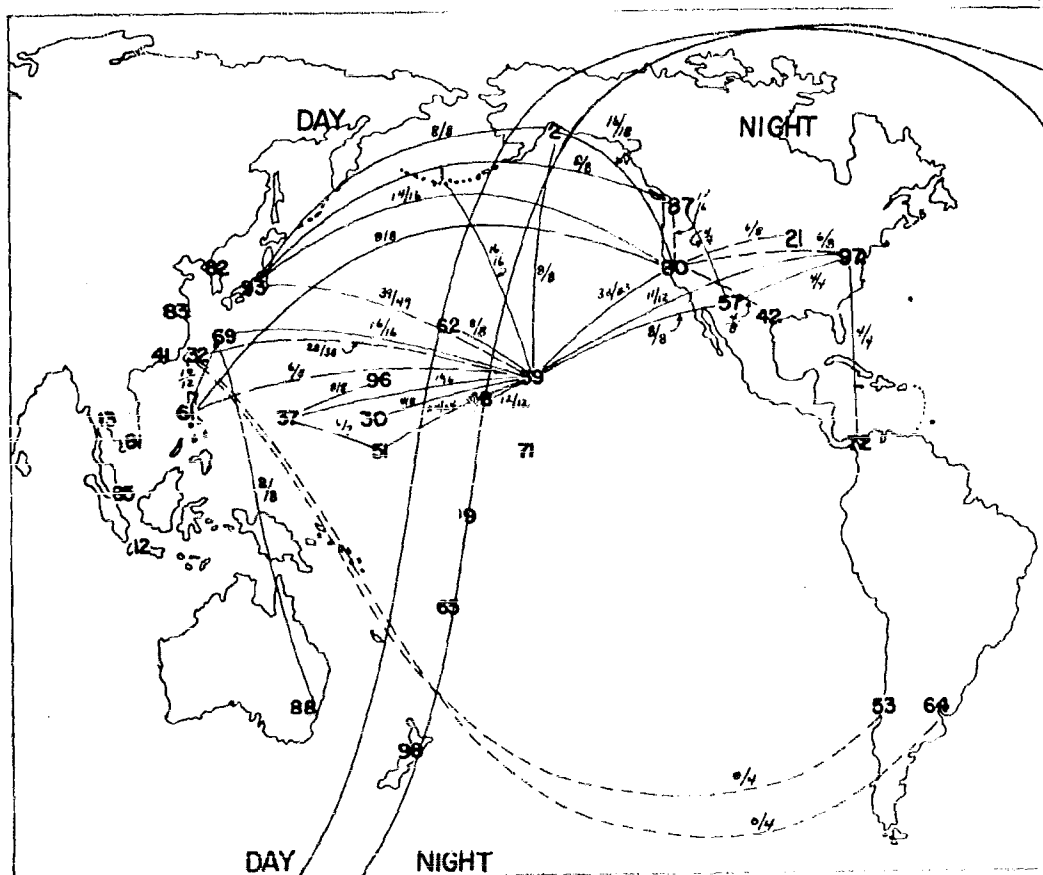
135

Figure 78b

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0600Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

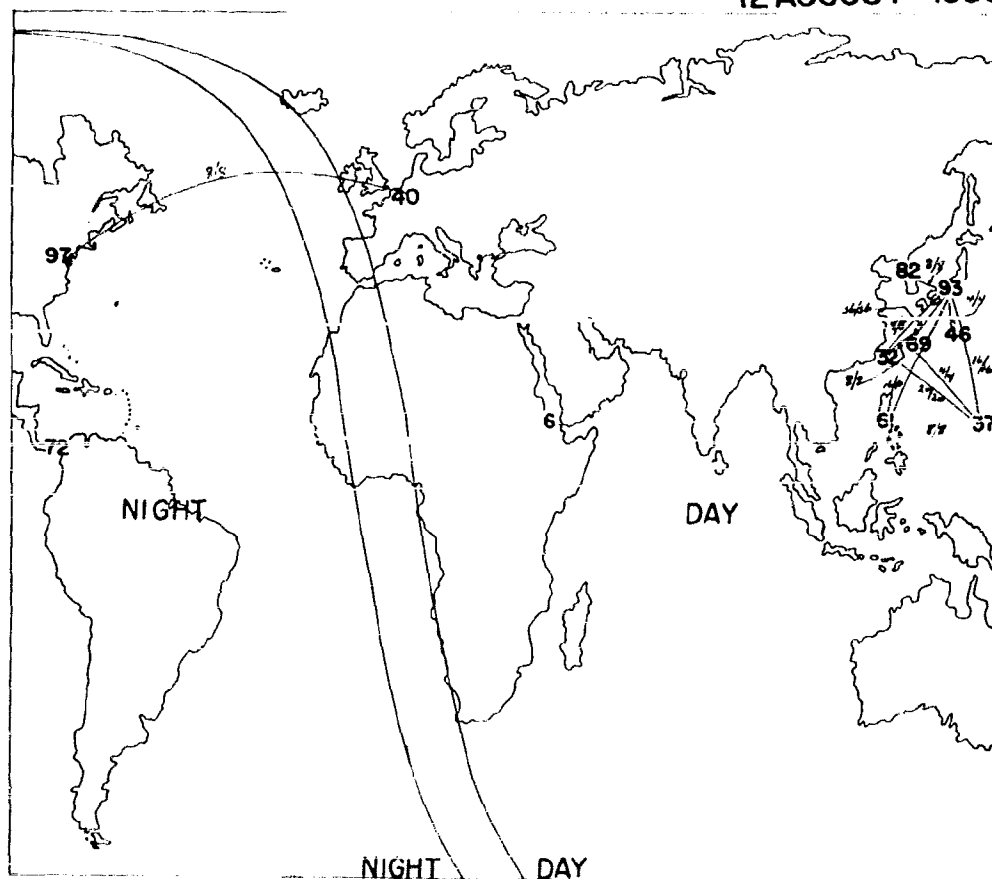
**SECRET**

Figure 79a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0600Z

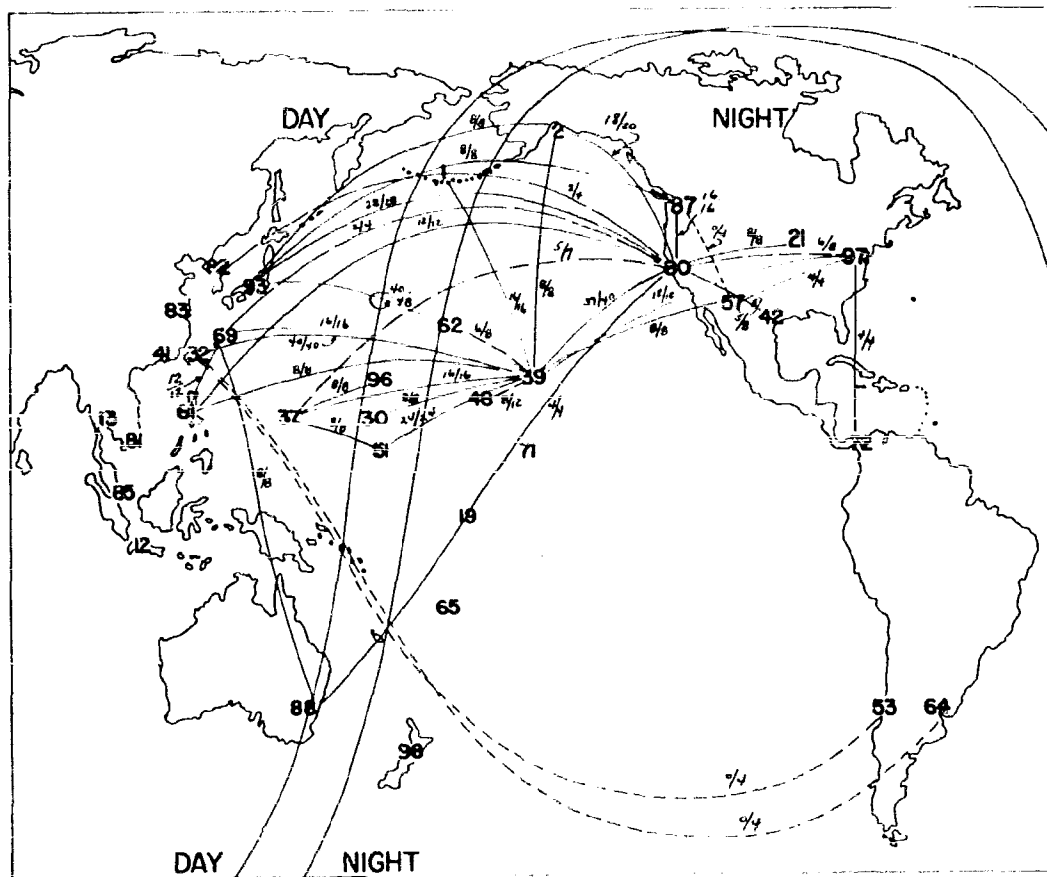
12 AUGUST 1958



**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0700Z

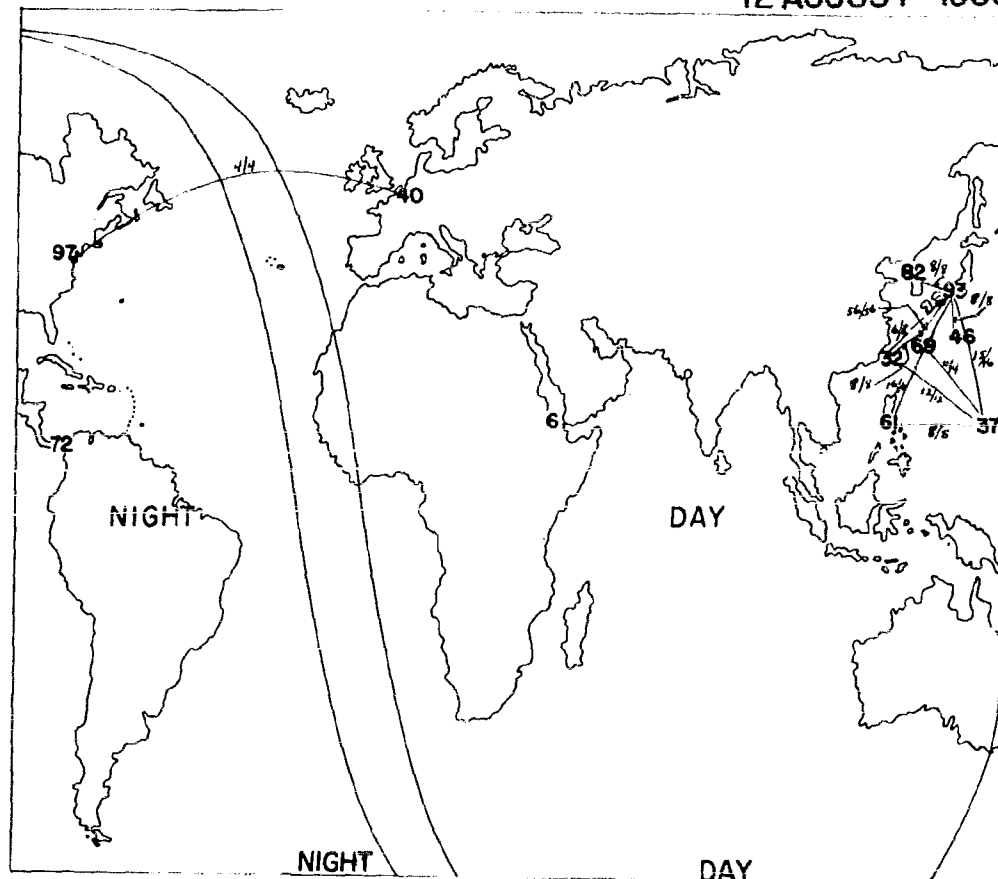
12 AUGUST 1958



**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0700Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————

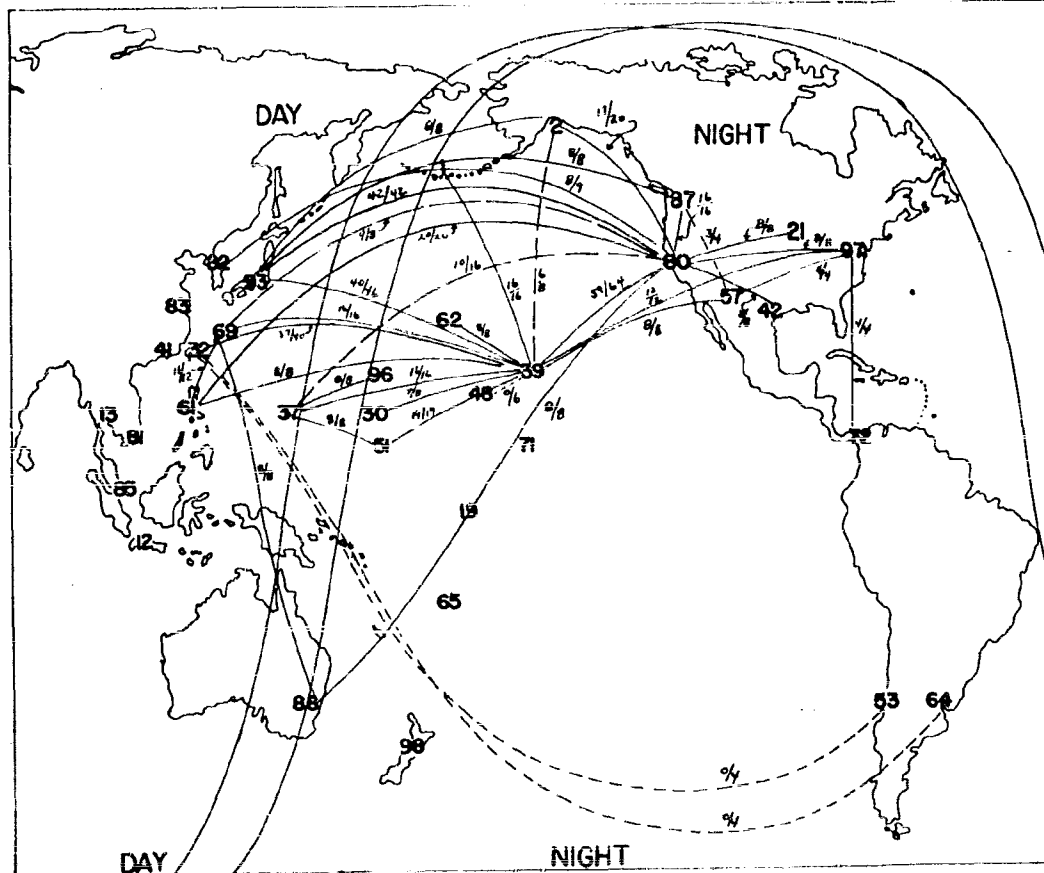
( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0800Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORAN	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANOI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**  
190

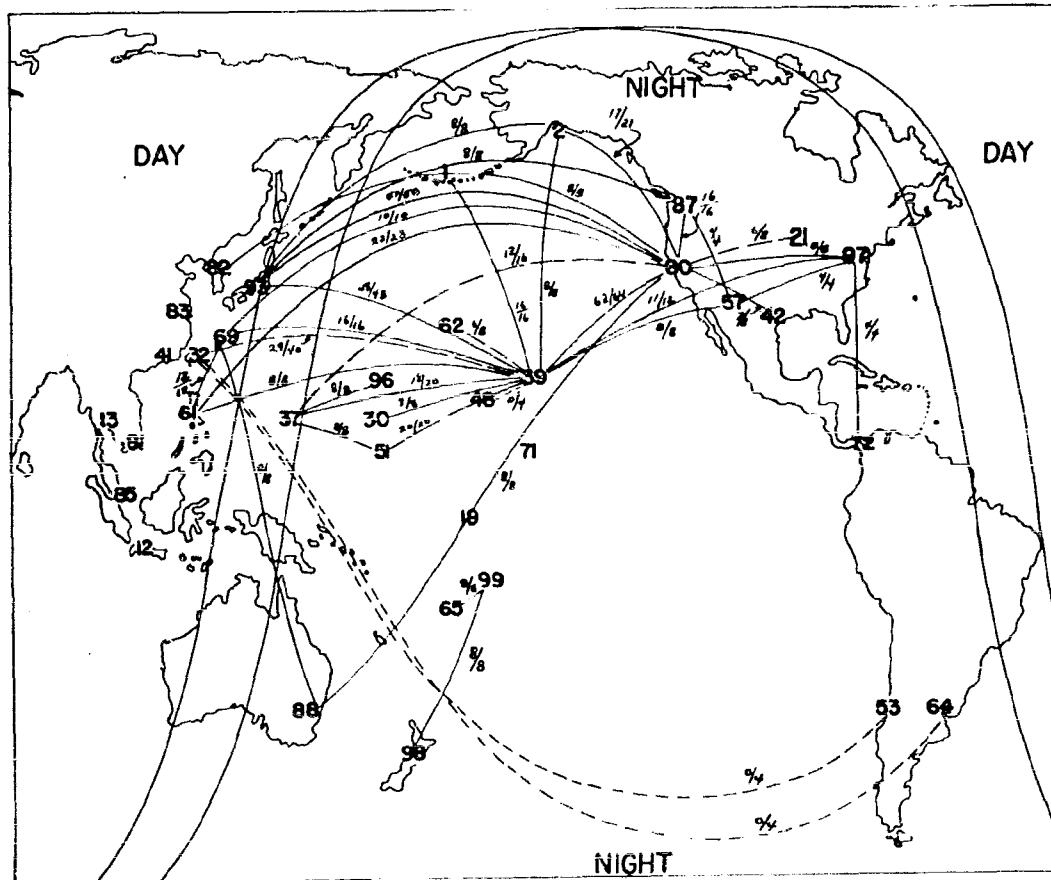
Figure 81a

TIME INTERVAL CENTERED ON: 0800Z

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0900Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

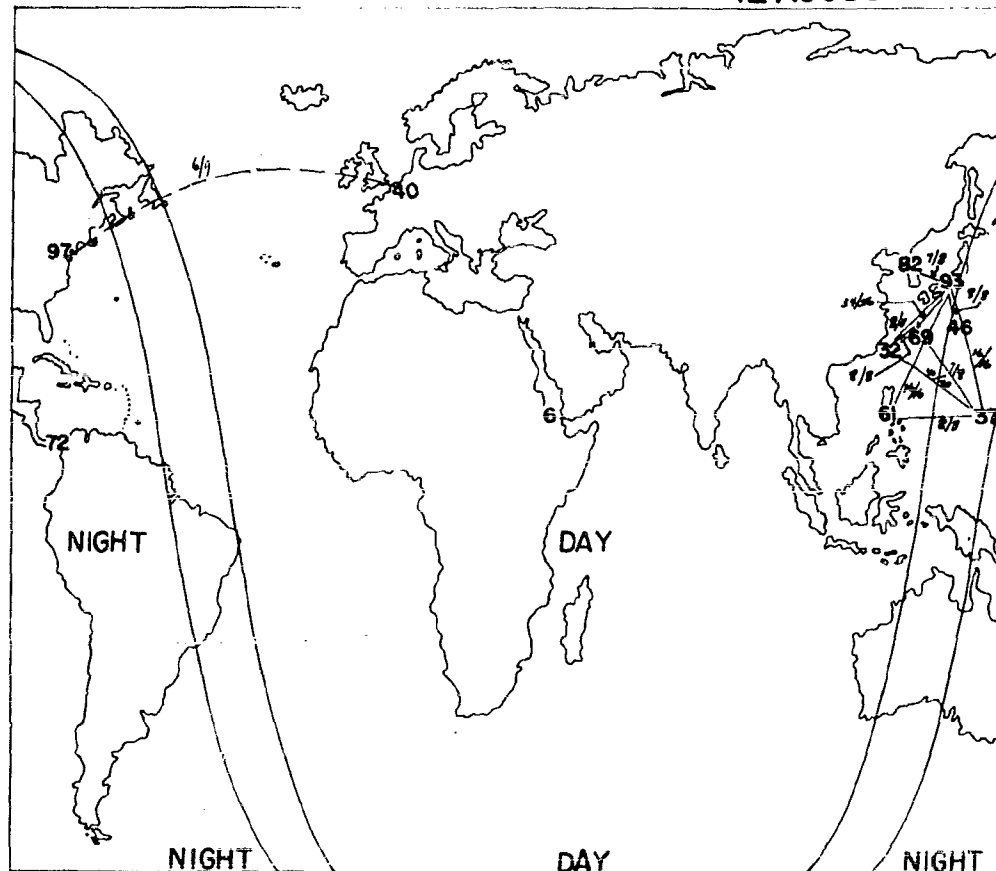
- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAK        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BAMBUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTICORANPE    | 83. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0900Z

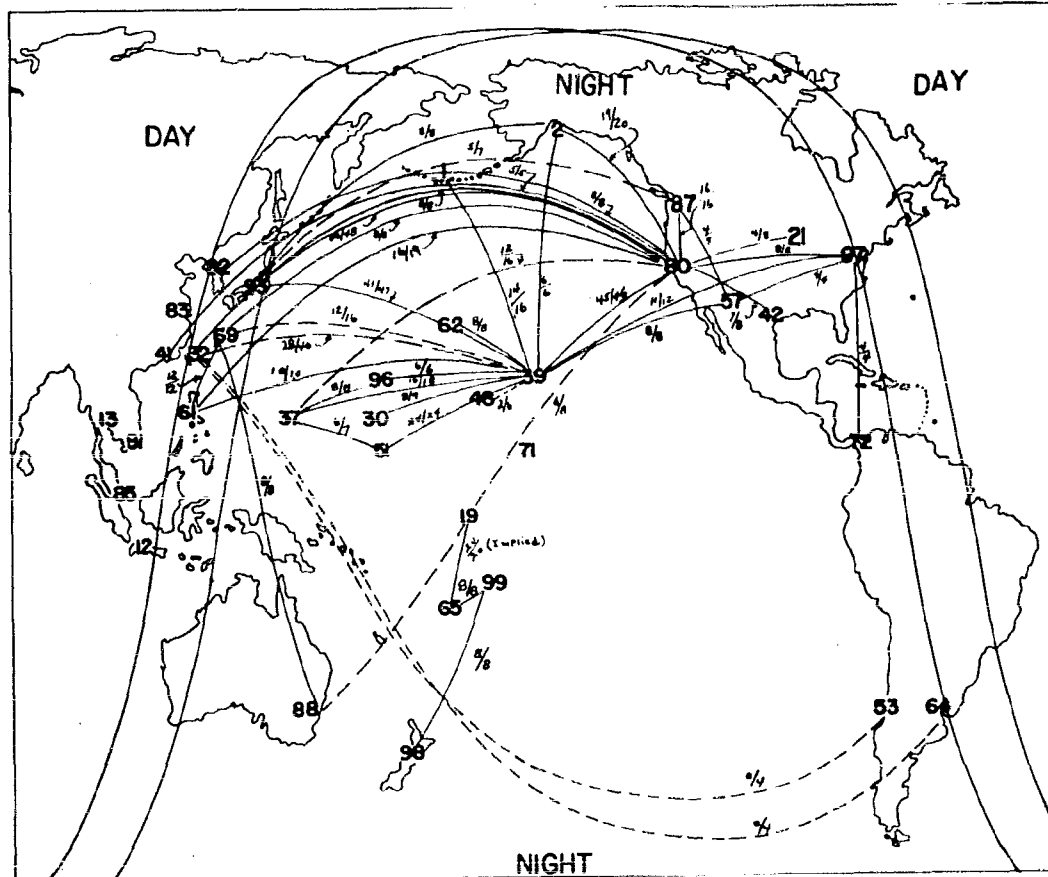
12 AUGUST 1958



**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1000Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

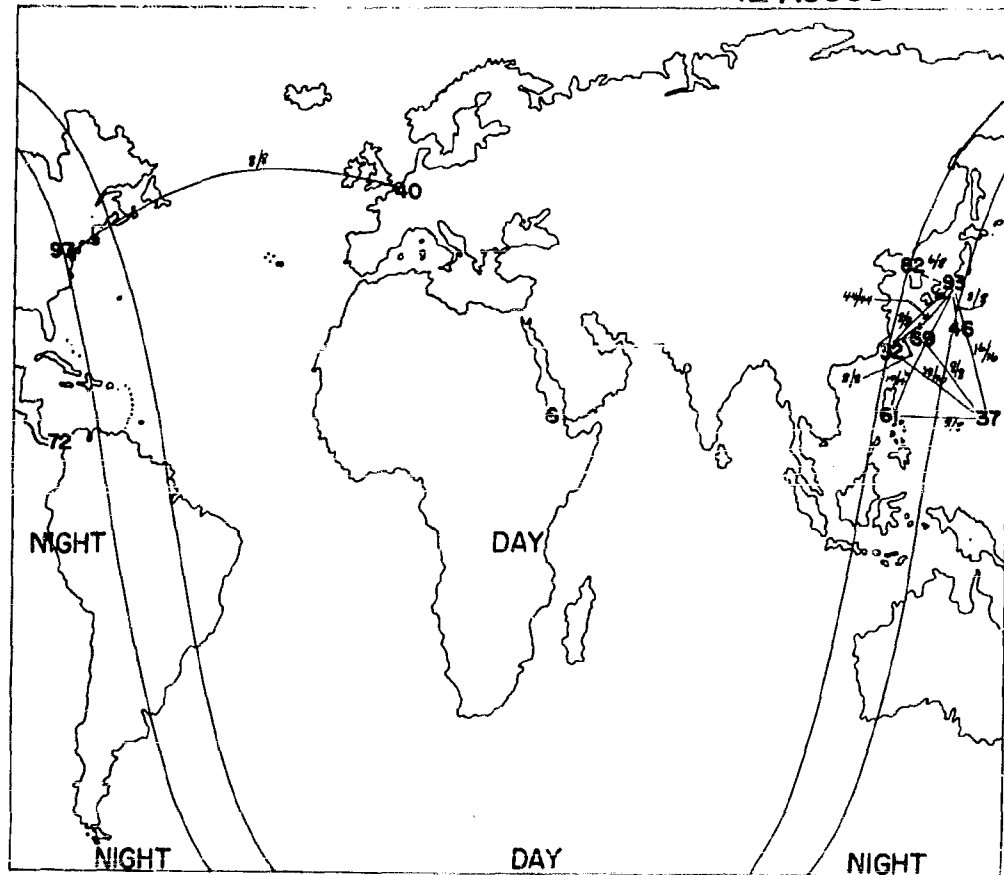
- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAX        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTIGRANDE     | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GUANZA        | 69. OKINAWA         | 83. SHANGHAI       |

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1000Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: — — — — —

80% to 100% of frequencies tried were useful: —————

( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)

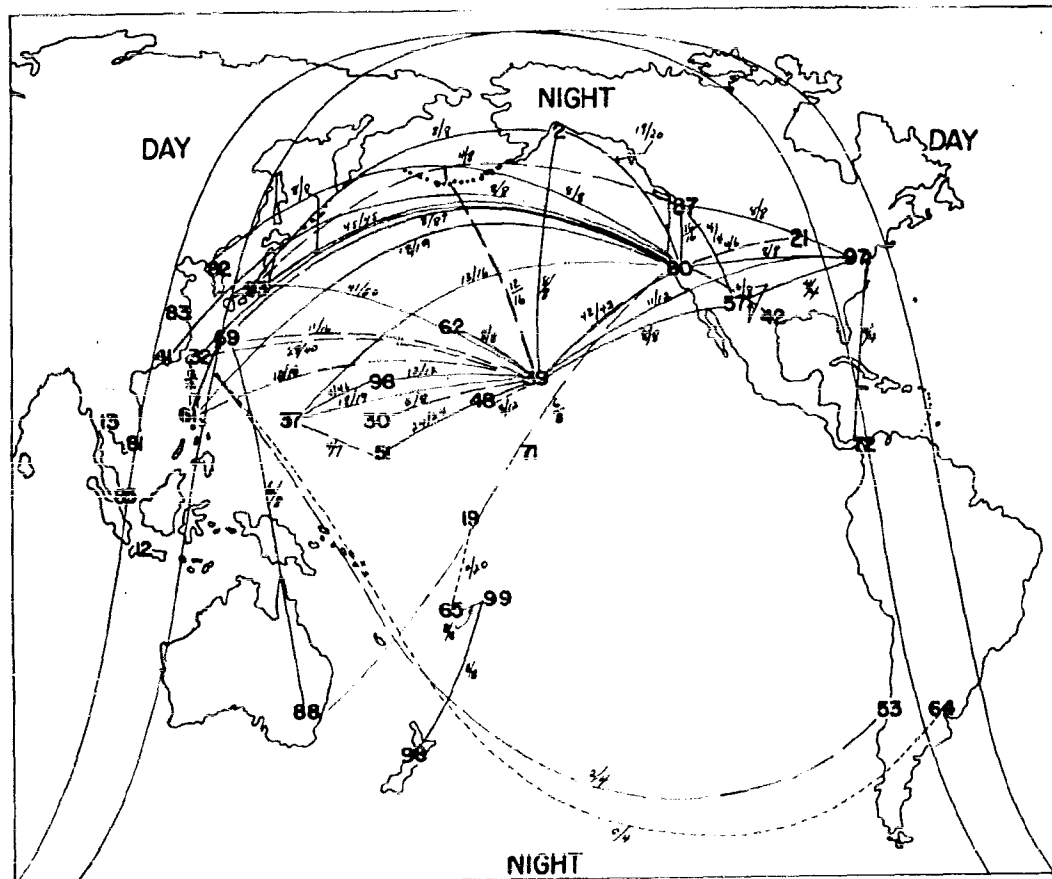
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1030Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANEE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NADI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

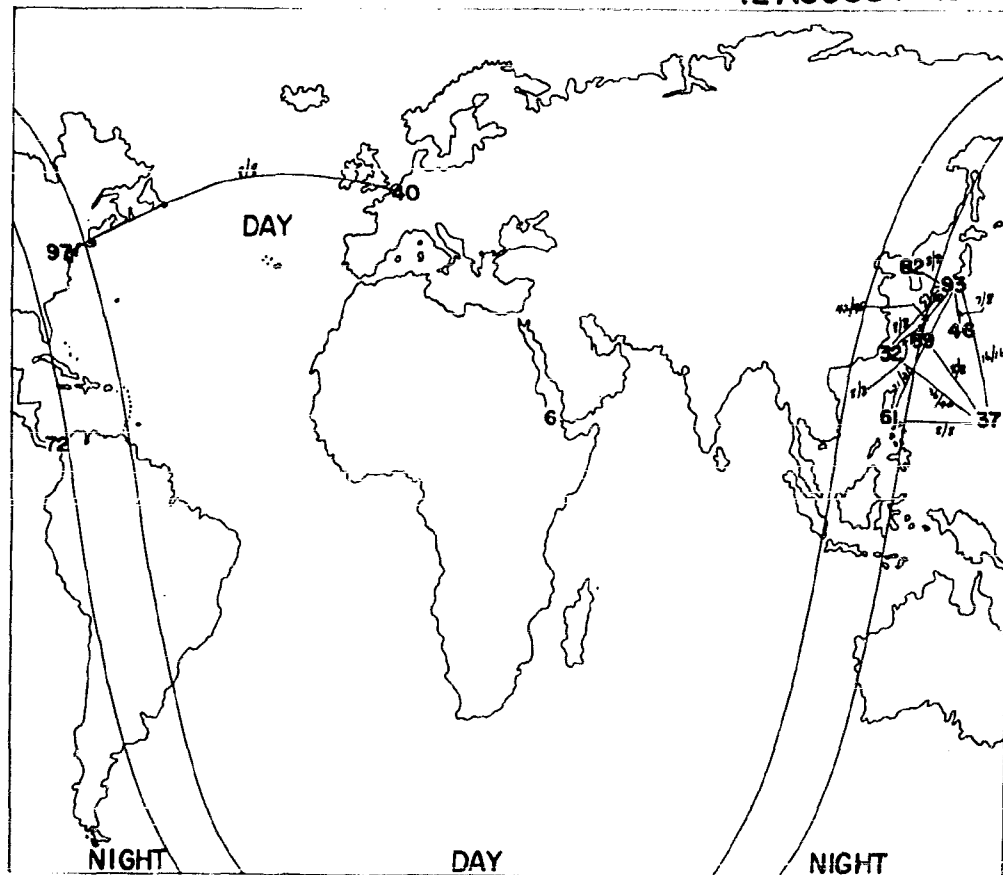
**SECRET**

Figure 84a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1030Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: - - - - -

80% to 100% of frequencies tried were useful: - - - - -

( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)

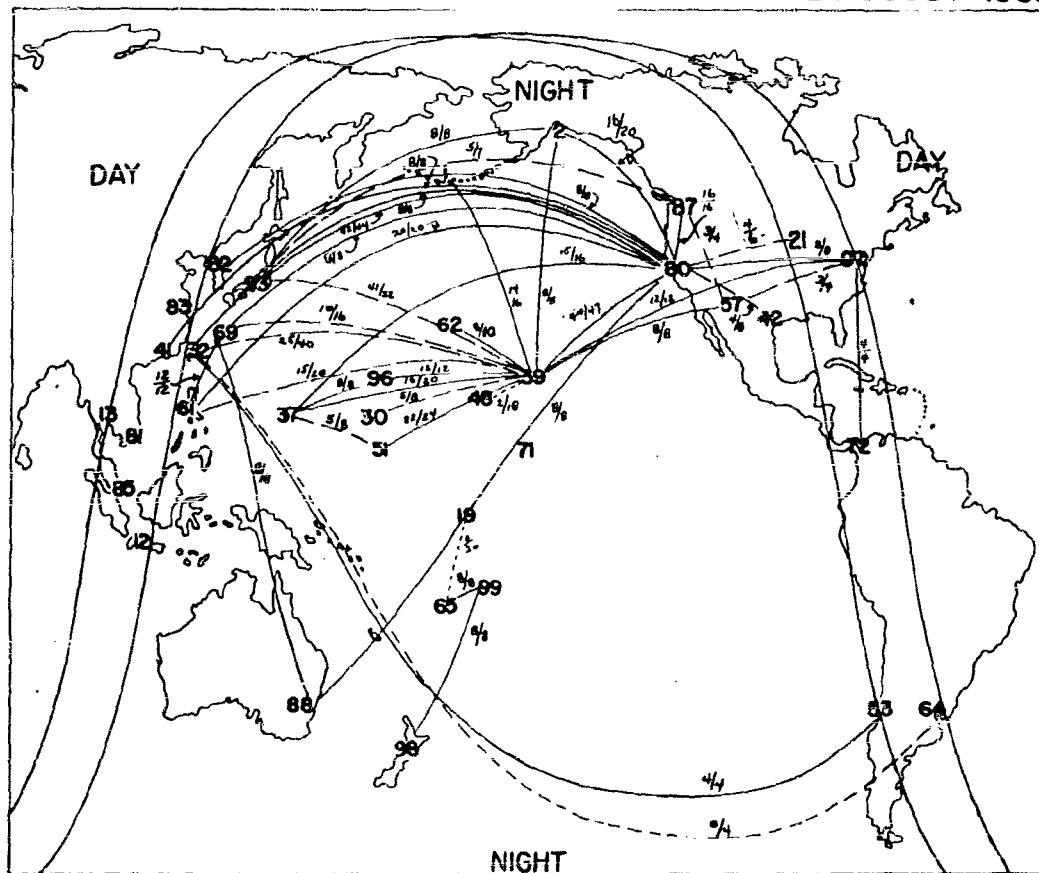
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1100Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICRANIE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

TIME INTERVAL CENTERED ON: 1100Z

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SMOA IS.

0% to 30% of frequencies tried were useful: -----  
30% to 80% of frequencies tried were useful: -----  
80% to 100% of frequencies tried were useful: -----

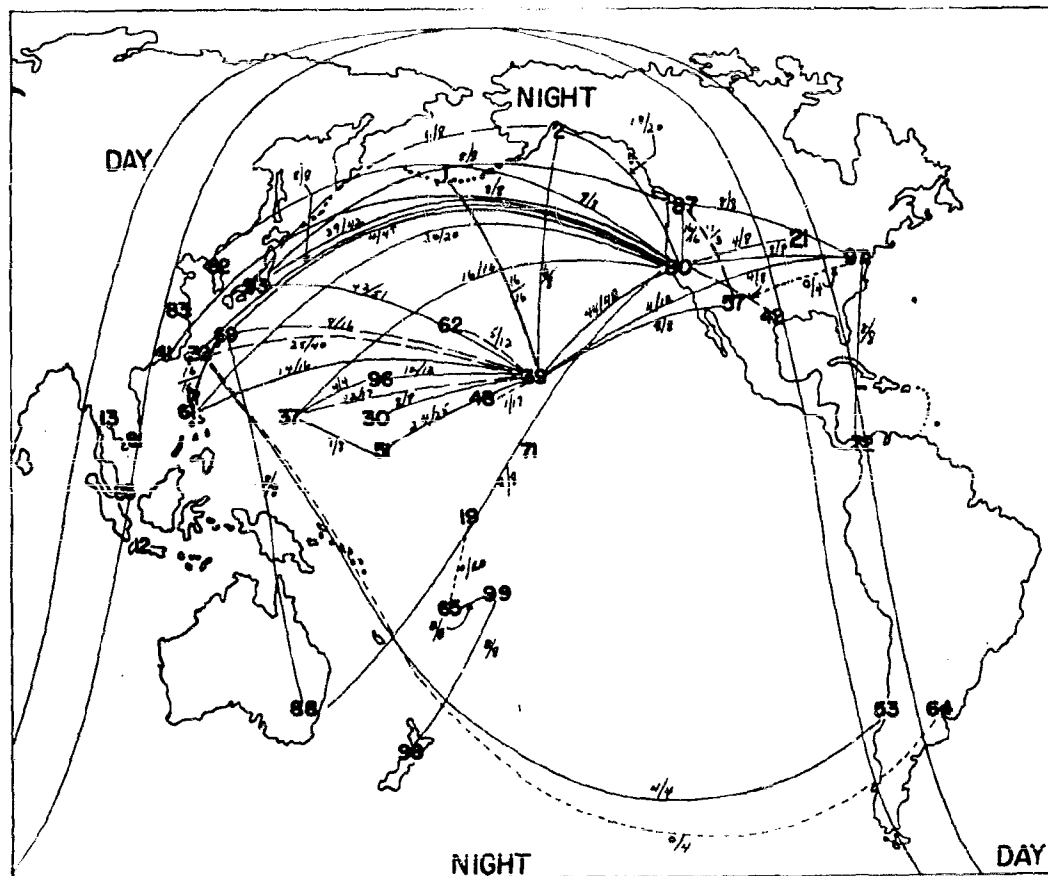
( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

Figure 85b.

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1130Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANGKOK	37. GUAM	48. JOHNSTON IS.	64. MONTICORAN	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

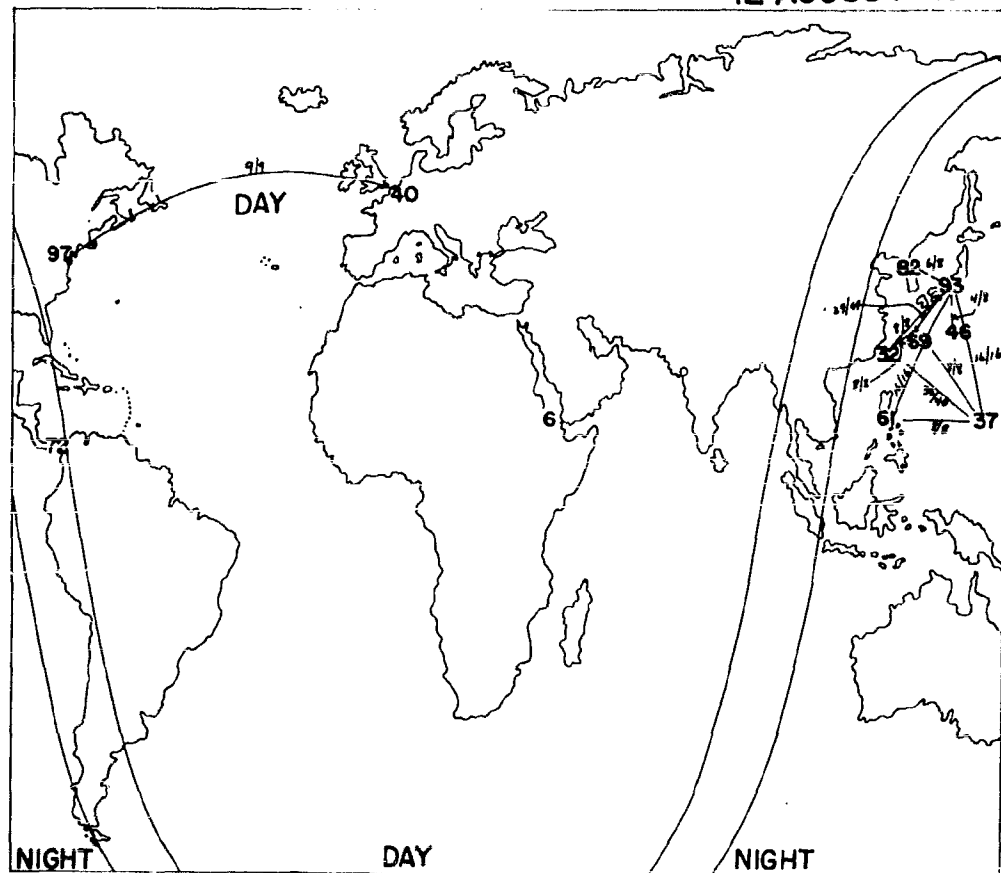
Figure 86a

**SECRET**  
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**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1130Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: ————

80% to 100% of frequencies tried were useful: —————

( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)

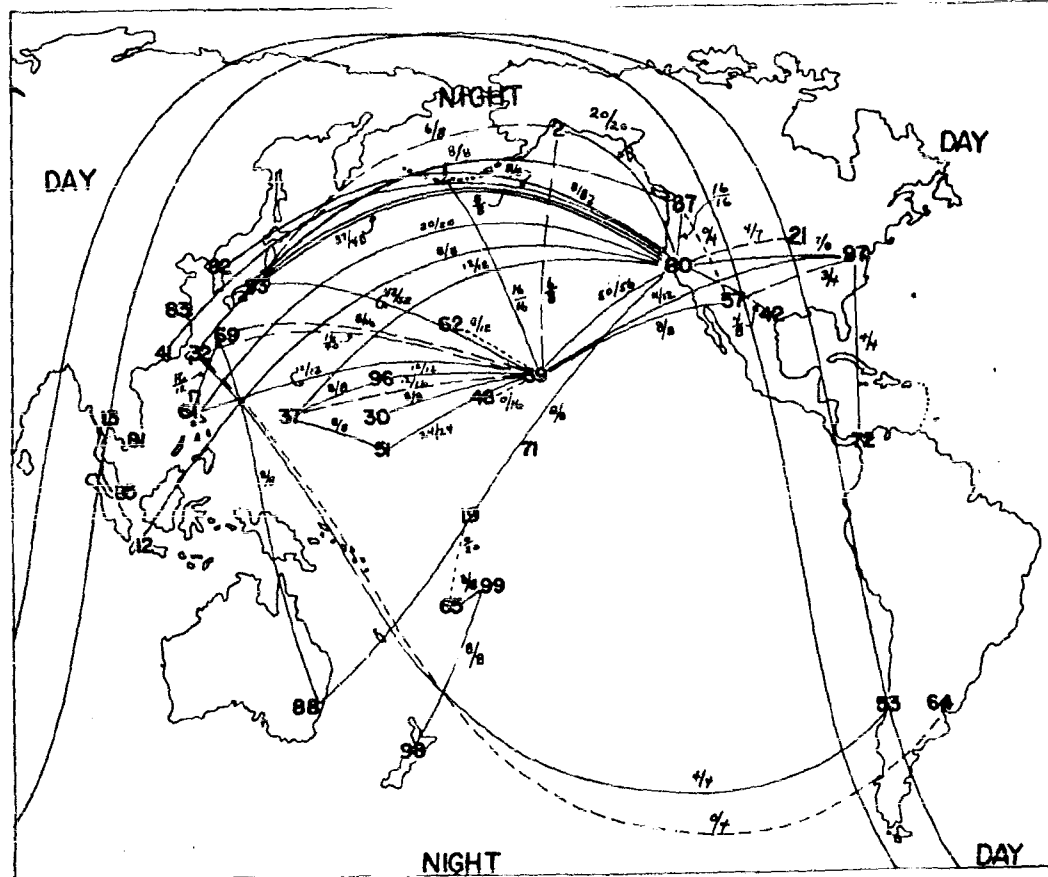
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1200Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORAN	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA ORANJA	69. OKINAWA	83. SHANGHAI

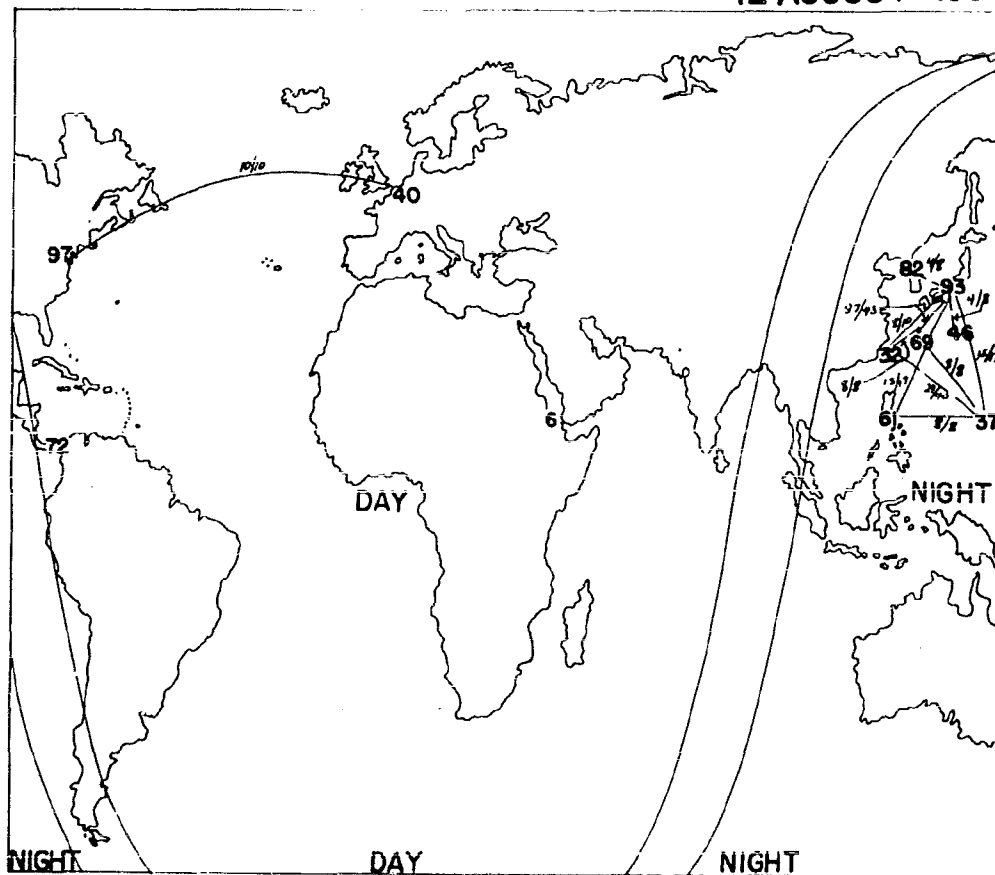
**SECRET**

Figure 87a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1200Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

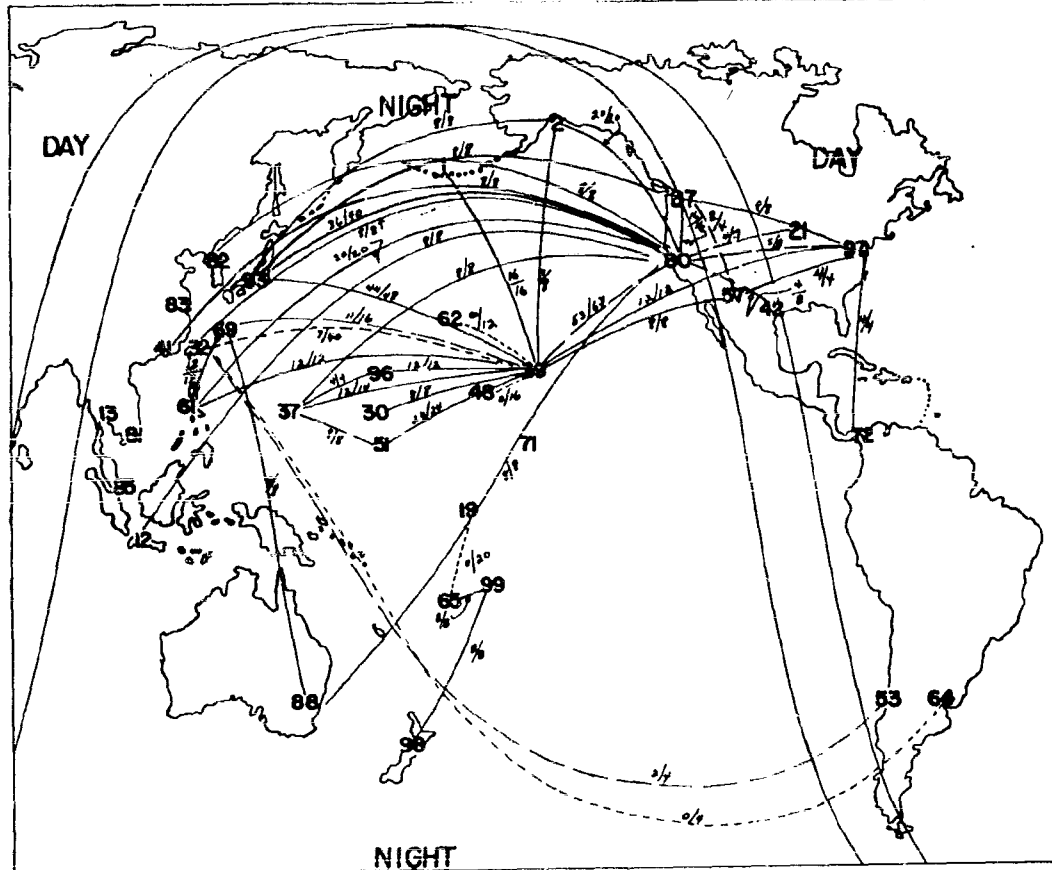
**SECRET**

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1230Z

12 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

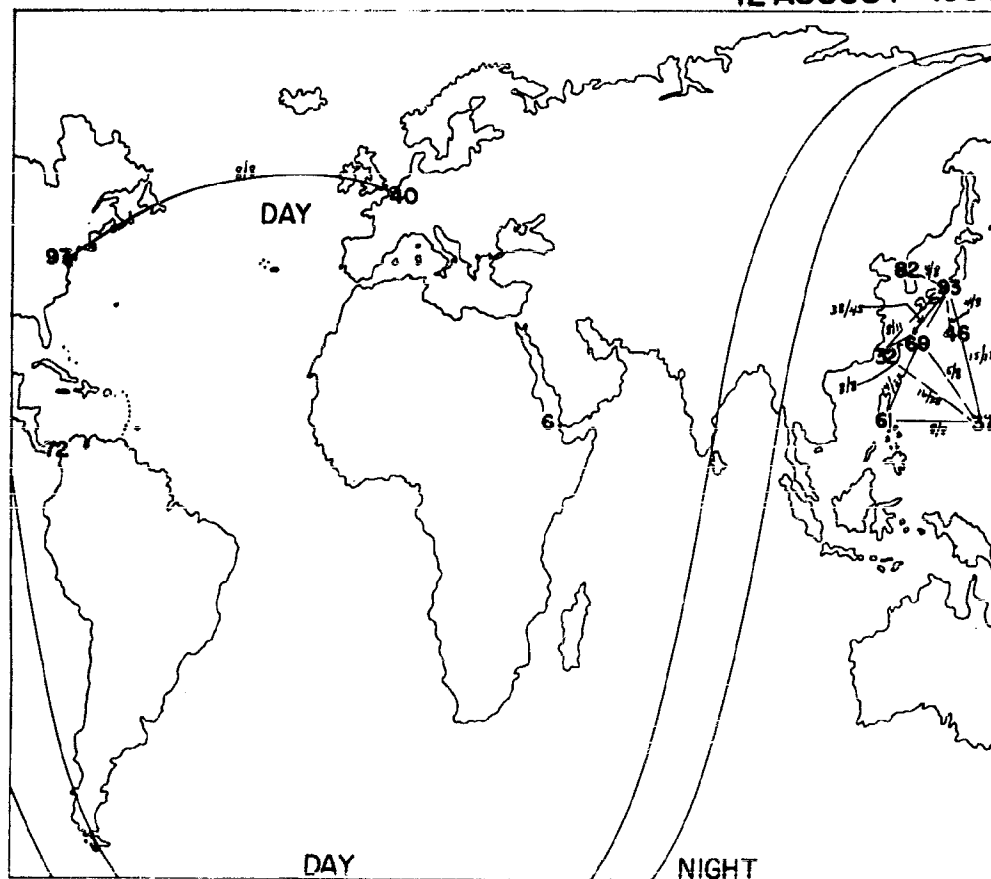
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1230Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

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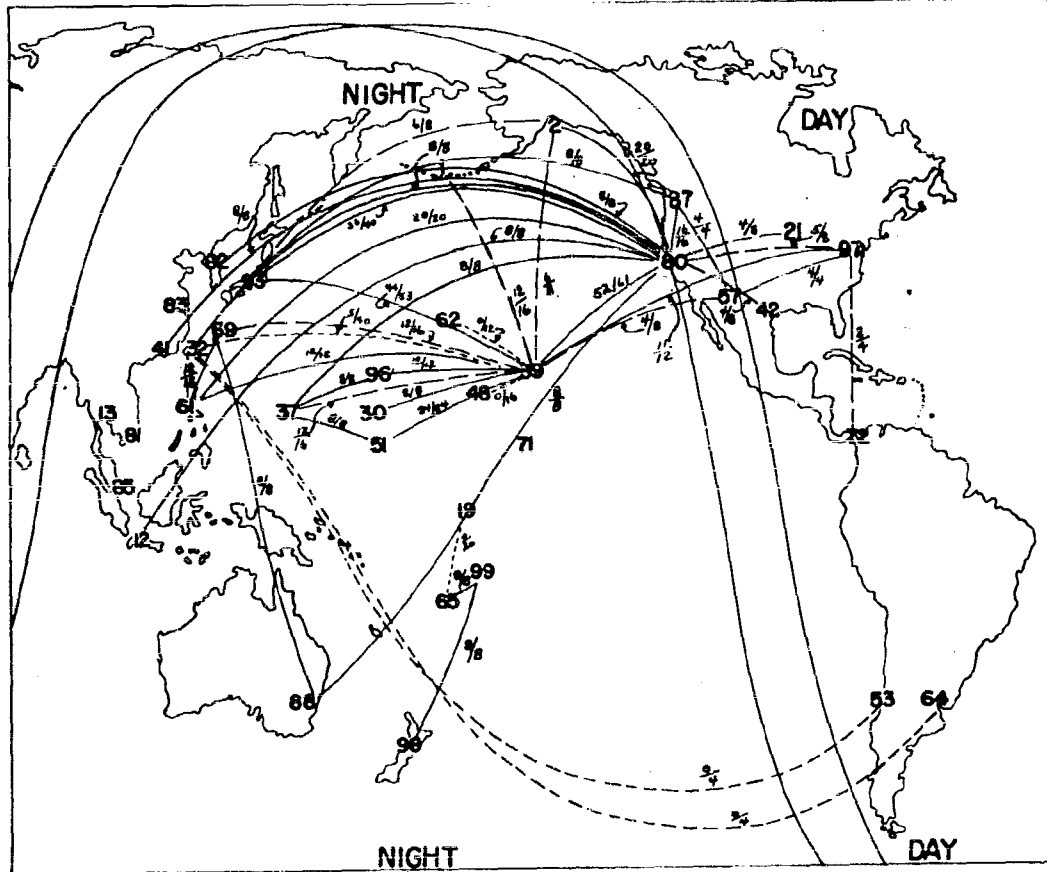
Figure 88b

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1300Z

12 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

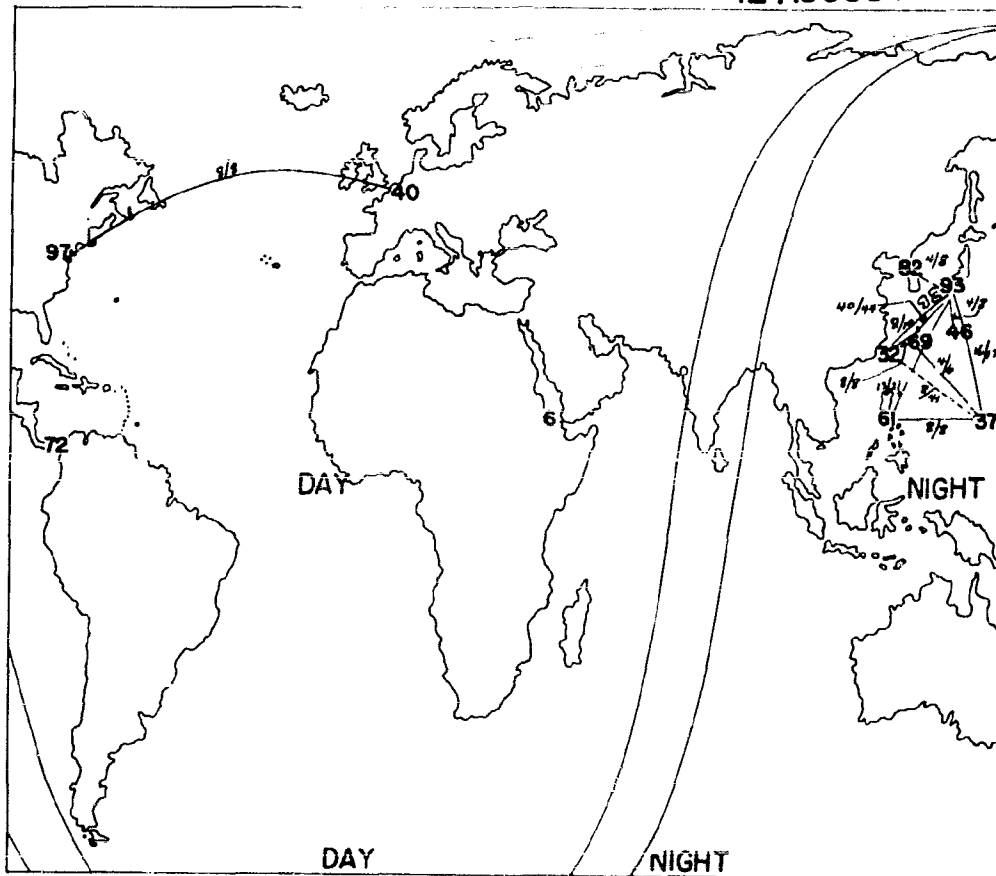
1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANGKOK	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1300Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————

( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

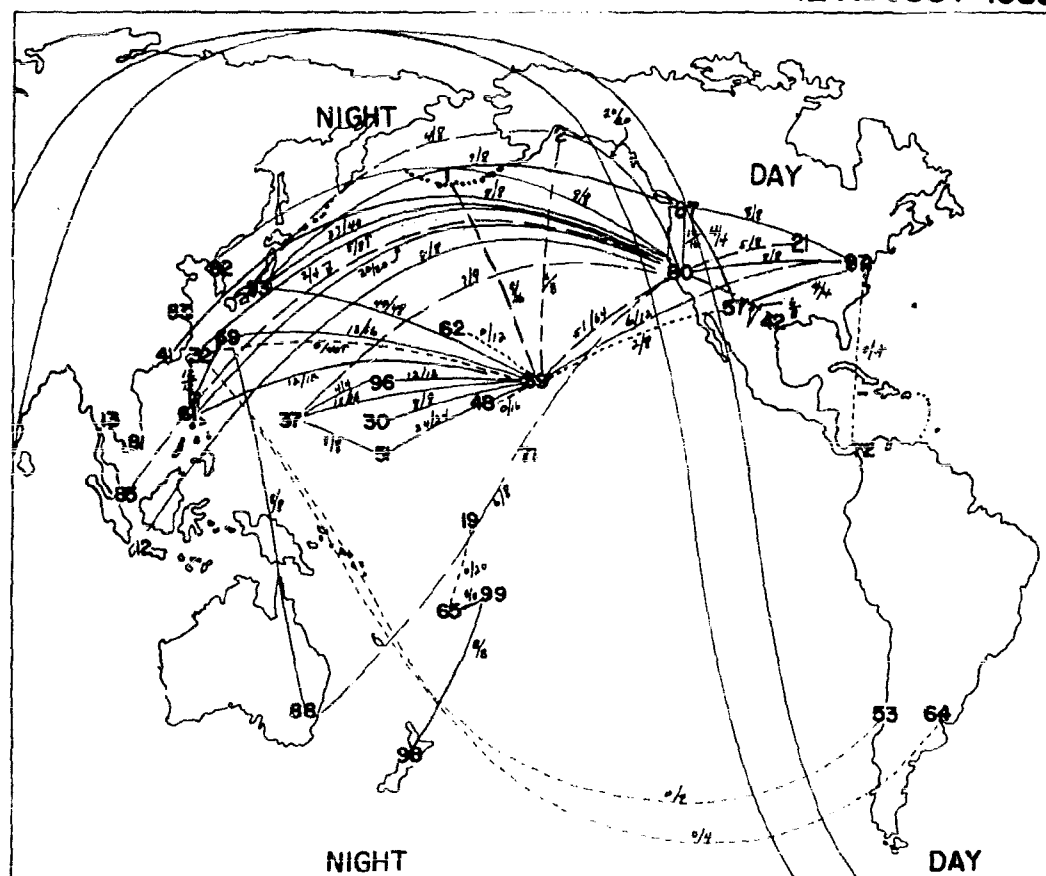
**SECRET**

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1330Z

12 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANGKOK	37. GUAM	48. JOHNSTON IS.	64. MONTICORAN	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. REIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

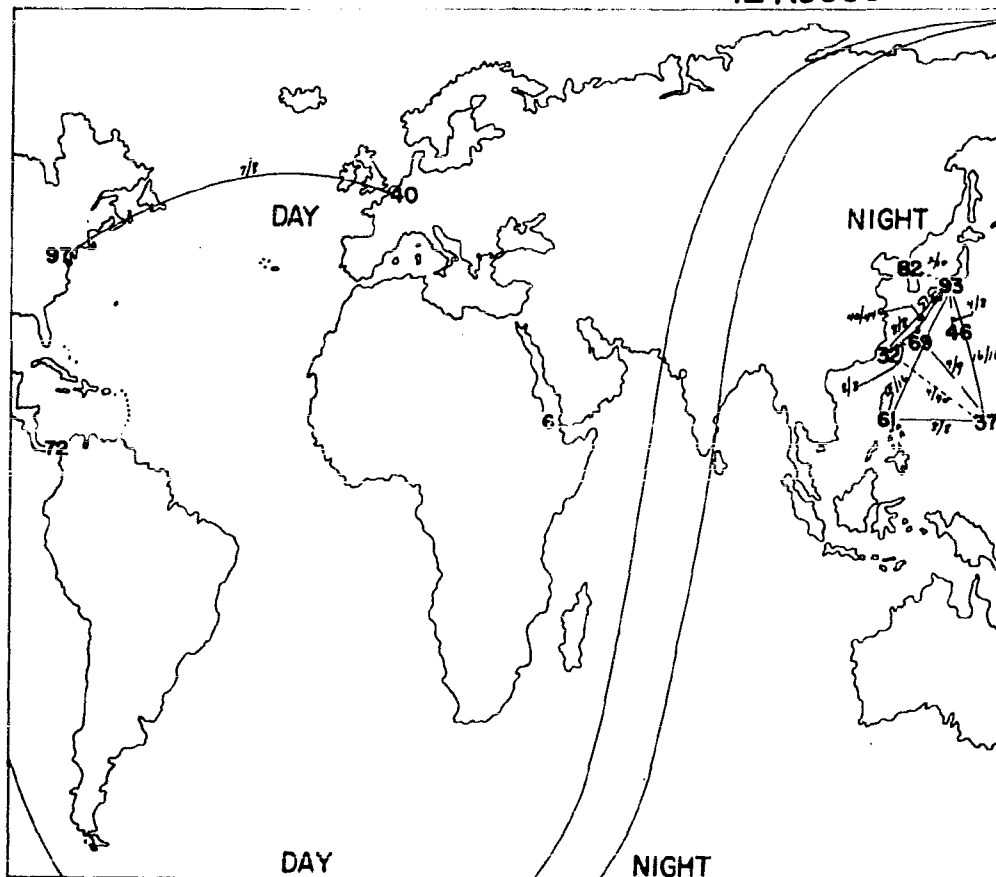
SECRET

Figure 90a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1330Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 83. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

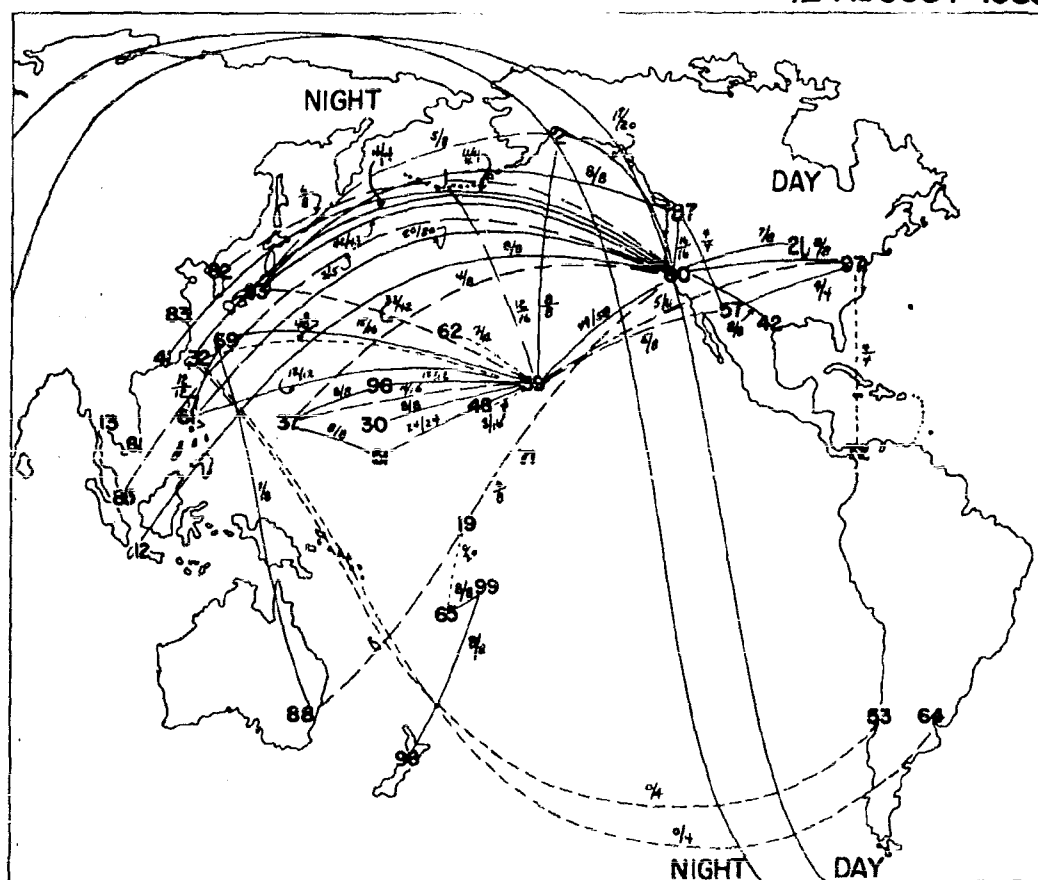
( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1400Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GHAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

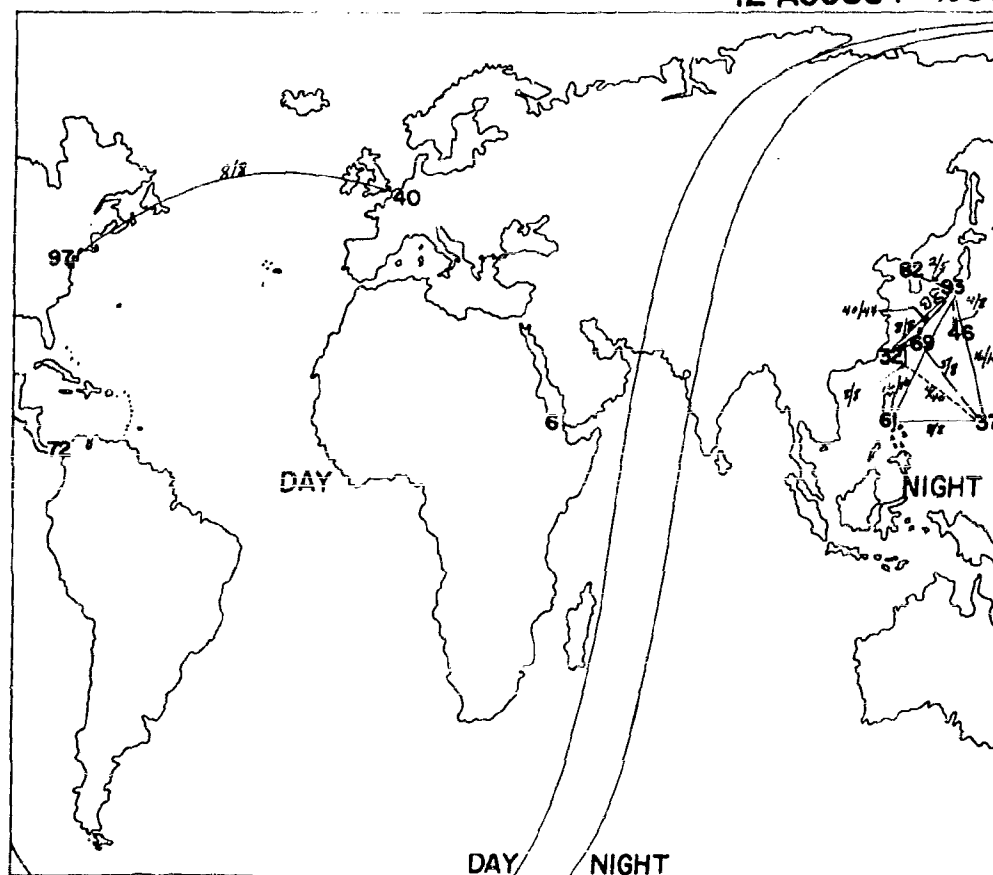
Figure 91a

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1400Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

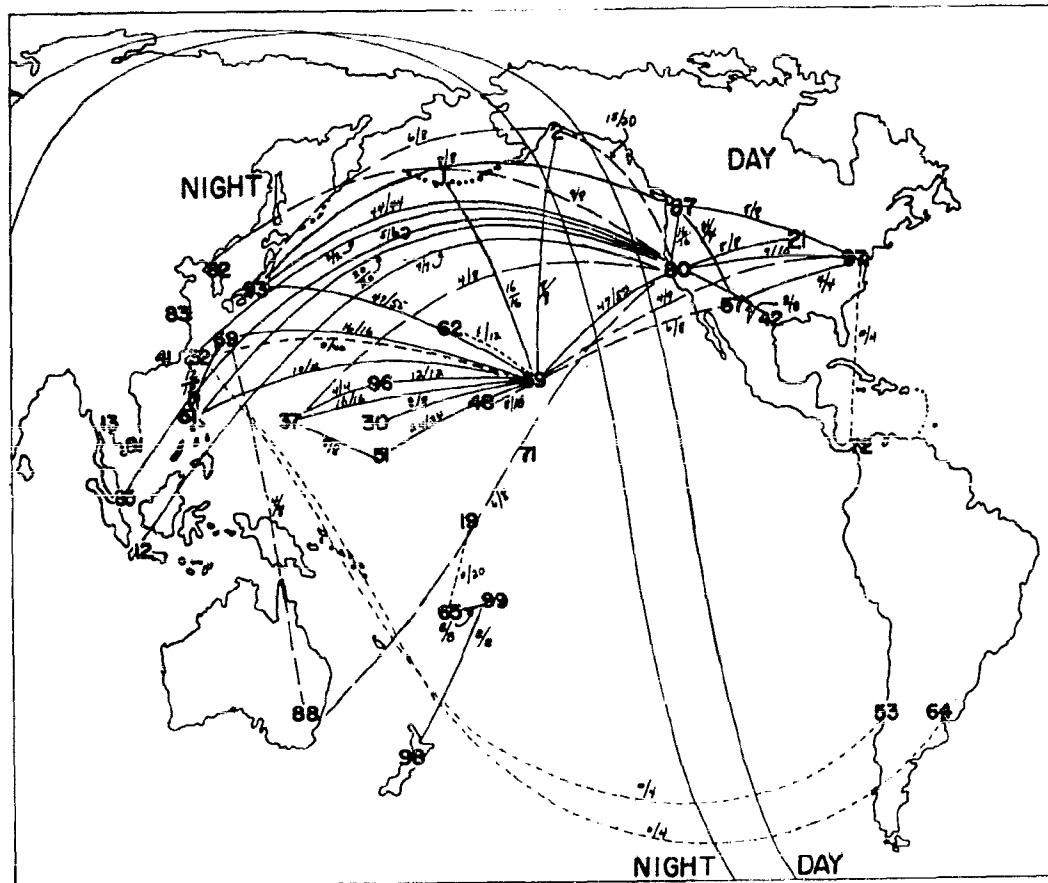
( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1430Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

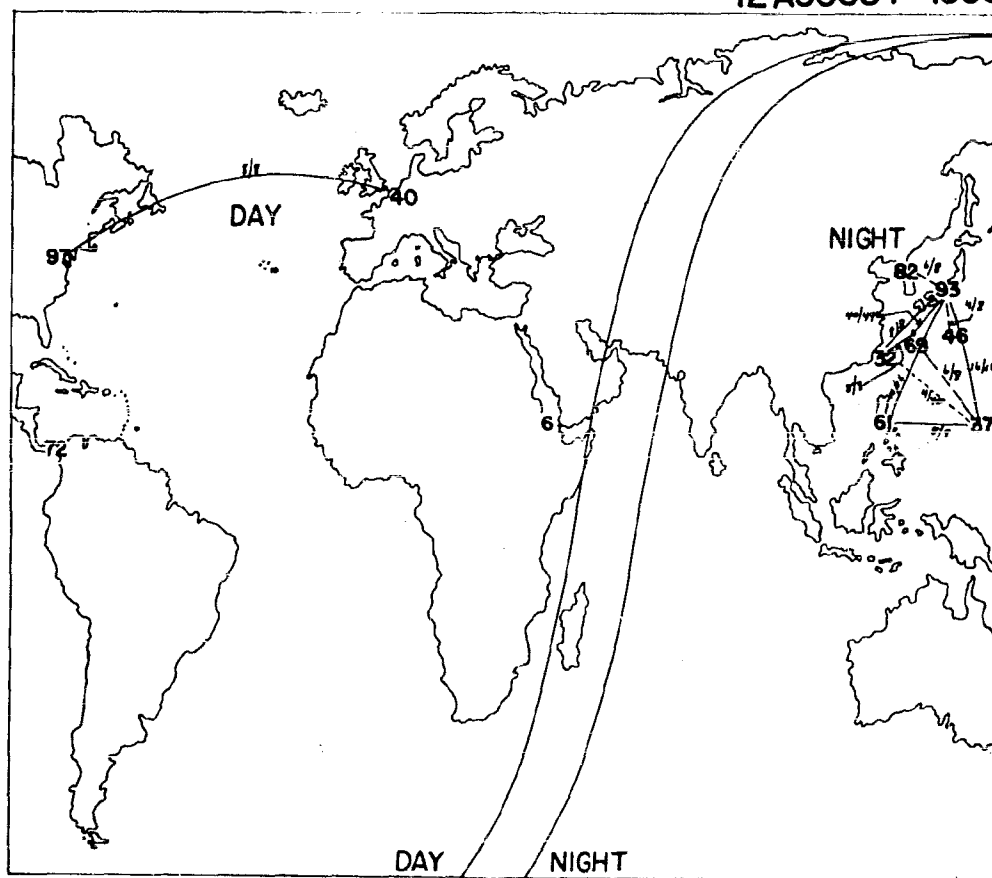
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. TWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NARDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1430Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: - - - - -

80% to 100% of frequencies tried were useful: - - - - -

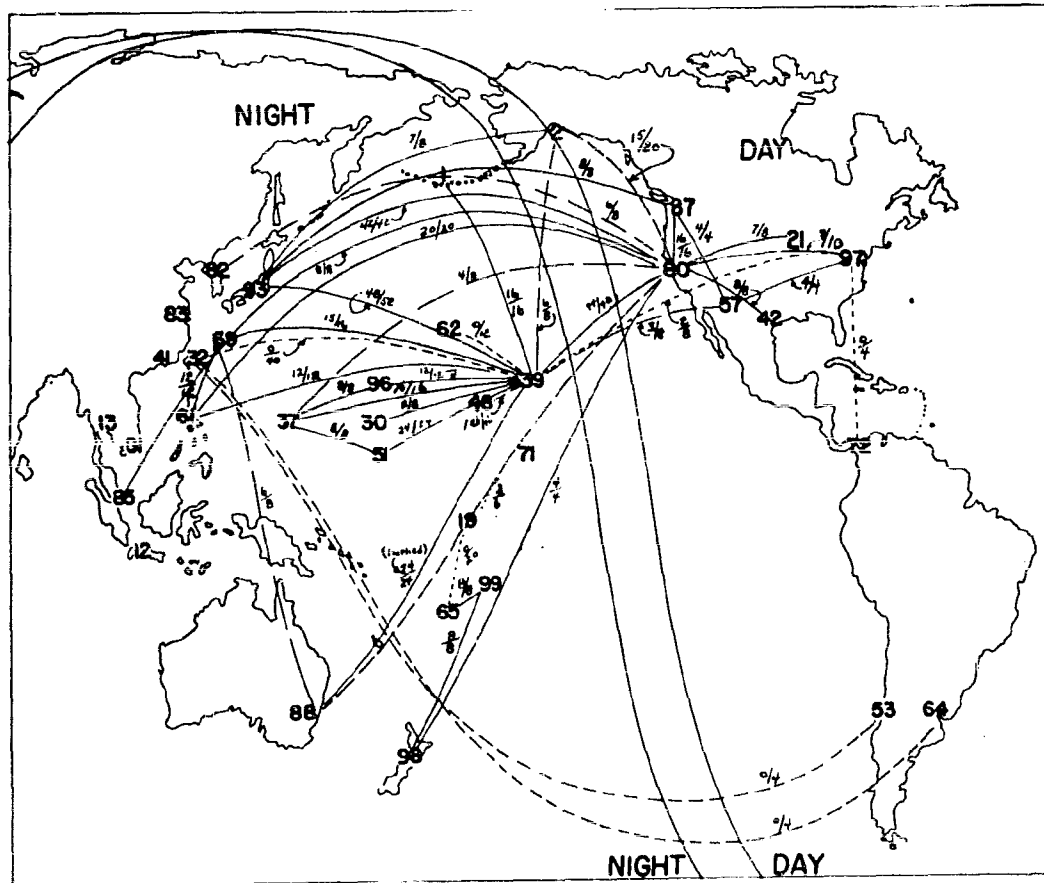
( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1500Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAK        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. TWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTICORANTH    | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANTU, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

Figure 93a

**SECRET**  
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TIME INTERVAL CENTERED ON: 1500Z

81. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SAMOA IS.

0% to 30% of frequencies tried were useful: -----  
30% to 80% of frequencies tried were useful: -----  
80% to 100% of frequencies tried were useful: -----

( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

**SECRET**

TIME INTERVAL CENTERED ON: 1530Z

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNNYON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

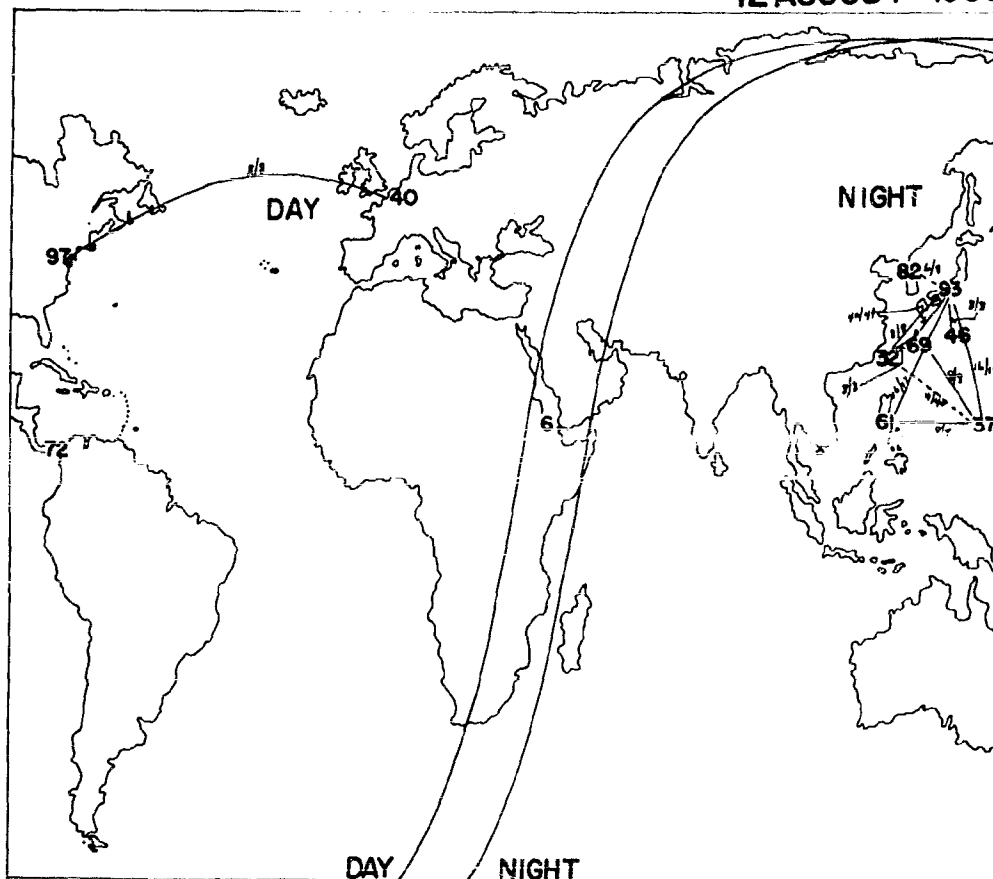
**SECRET**  
216

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1530Z

12 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

### KEY TO FREQUENCY UTILITY

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: ————

80% to 100% of frequencies tried were useful: —————

( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)

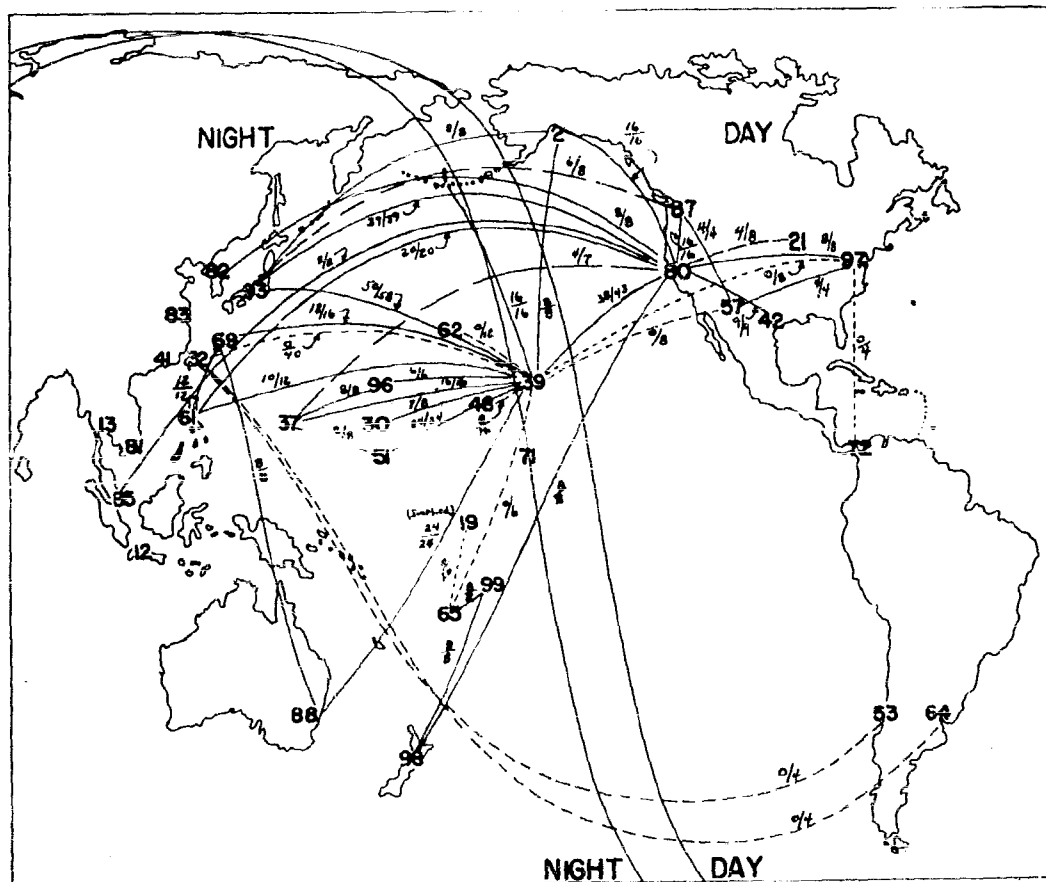
, Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

# SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1600Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMAHA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANOI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANZA	69. OKINAWA	83. SHANGHAI

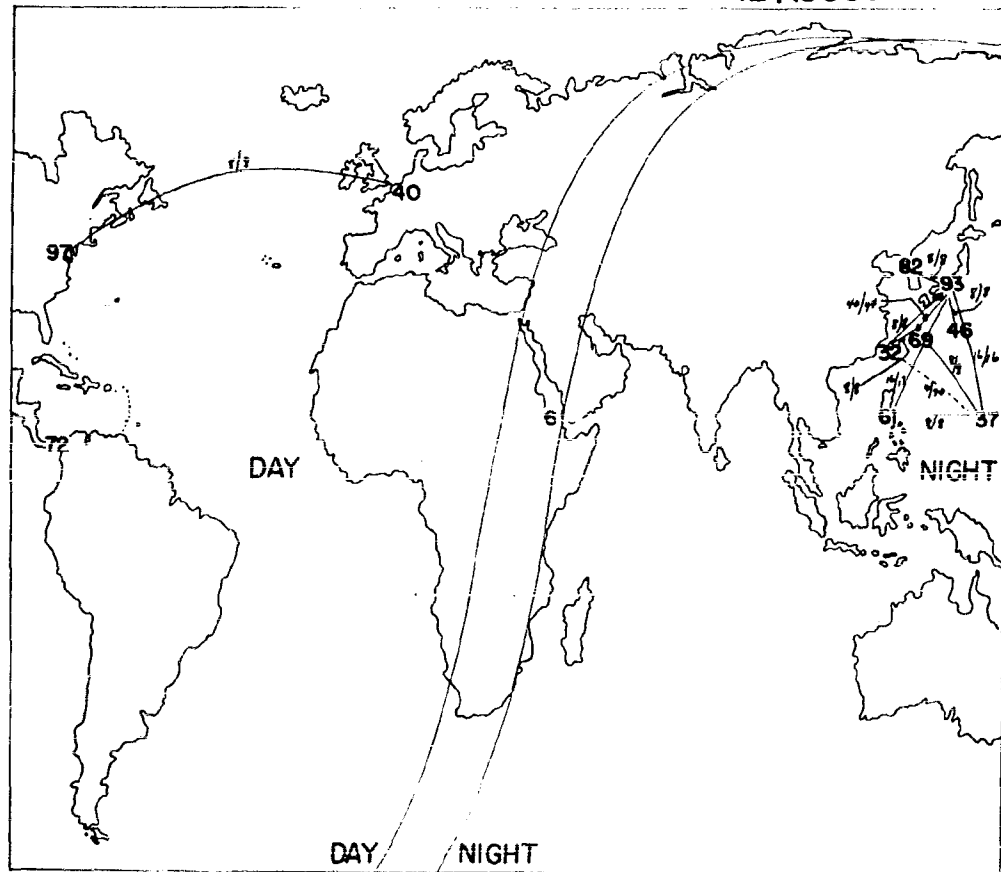
**SECRET**

Figure 95a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1600Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SAMOA IS.

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -  
 30% to 80% of frequencies tried were useful: ————  
 80% to 100% of frequencies tried were useful: —————

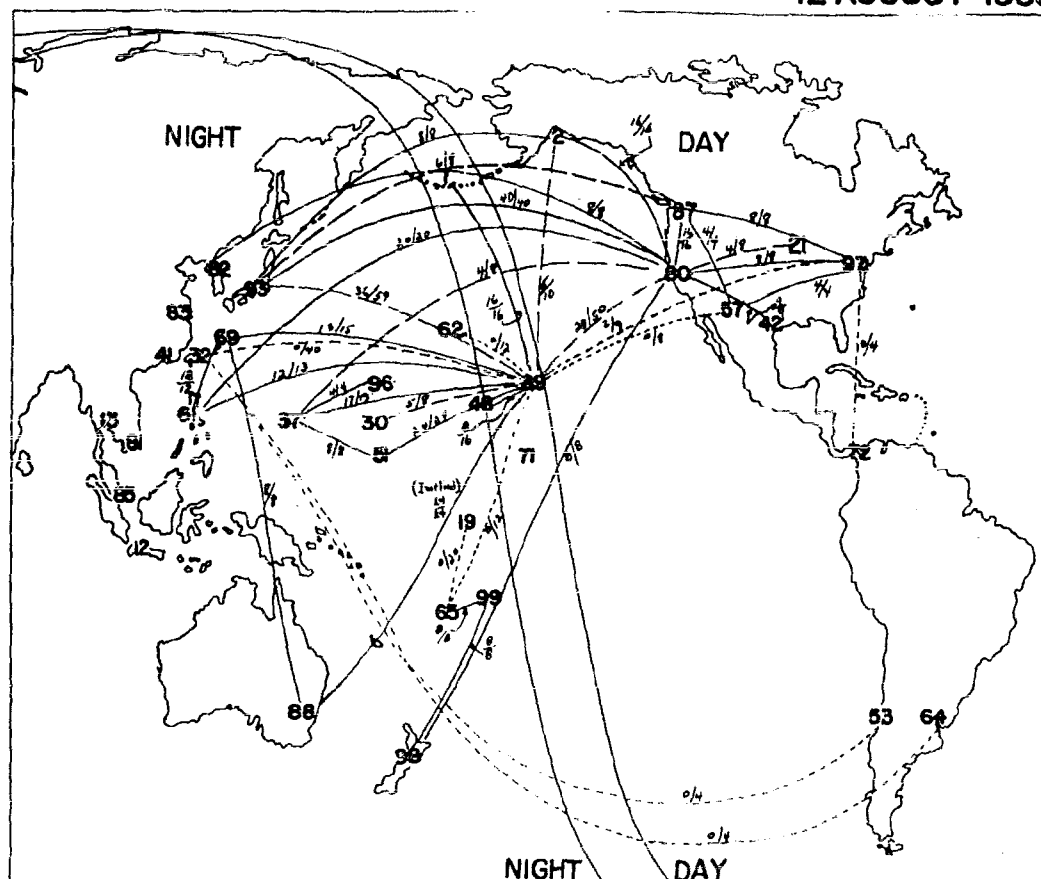
( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)

Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**  
**TIME INTERVAL CENTERED ON: 1630Z**

**12 AUGUST 1958**



KEY TO TERMINAL LOCATIONS

1. ADIAK	21. CHICAGO	41. HONKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASHARA	32. FORMOSA	46. TWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANDHAI

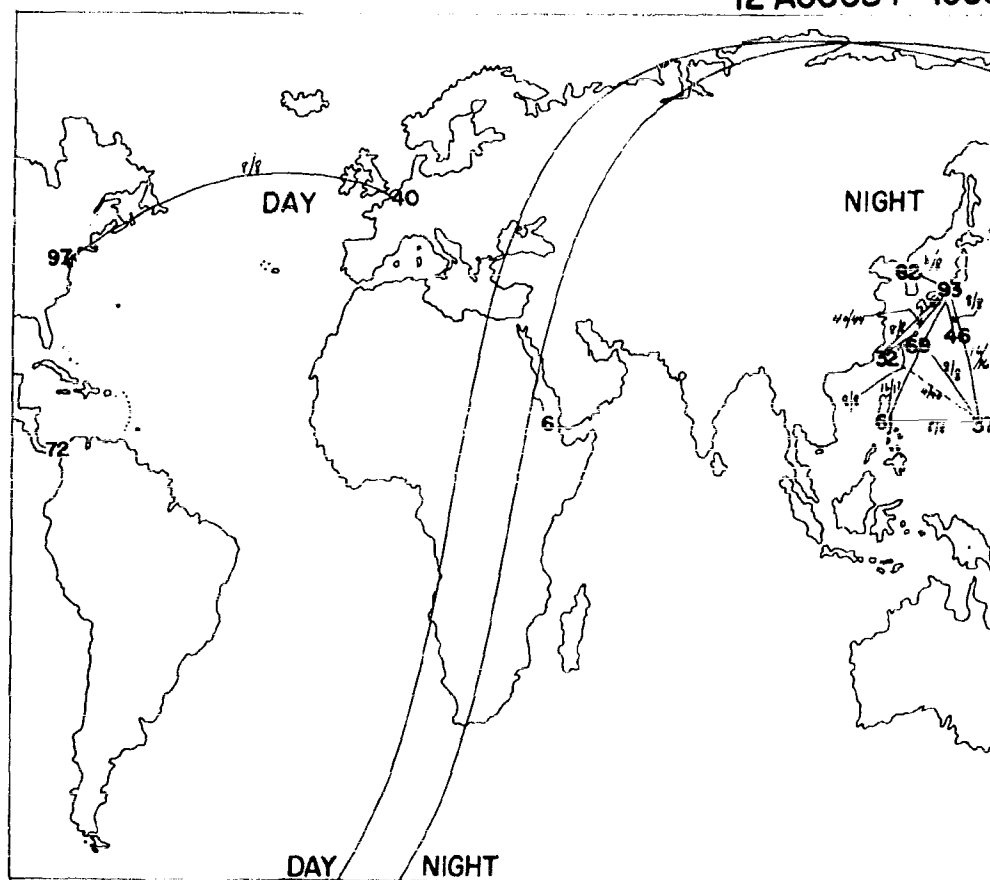
**SECRET**

SECRET

# SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1630Z

12 AUGUST 1958



## KEY TO TERMINAL LOCATIONS

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SAMOA IS.

## KEY TO FREQUENCY UTILITY

0% to 30% of frequencies tried were useful: -----  
30% to 80% of frequencies tried were useful: -----  
80% to 100% of frequencies tried were useful: -----

( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
denominator is 4 x (number of frequency hours attempted  
during hour interval depleted.)

SECRET

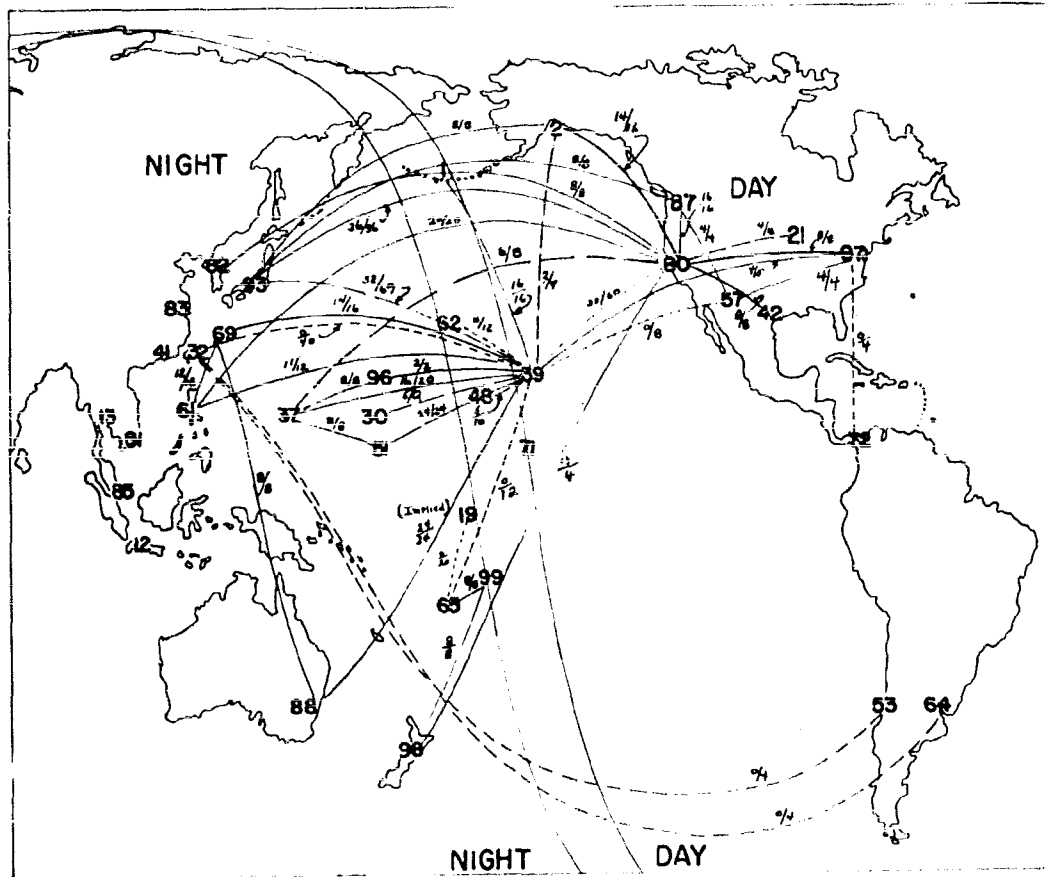
271

Figure 96b

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1700Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

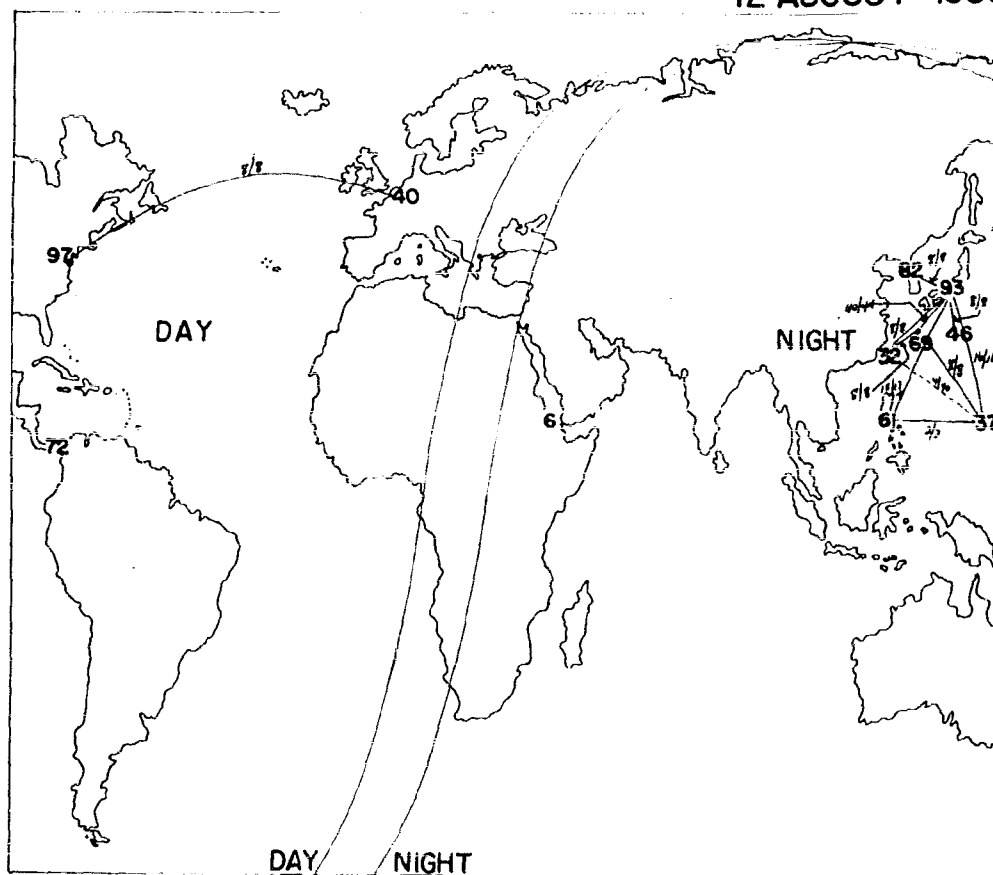
1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICRANIE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NADI, FIJI IS.	82. SEAGUL
19. CANTON IS.	40. HEIDELBERG	53. LA GUANIA	67. OKINAWA	84. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1700Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAIDA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

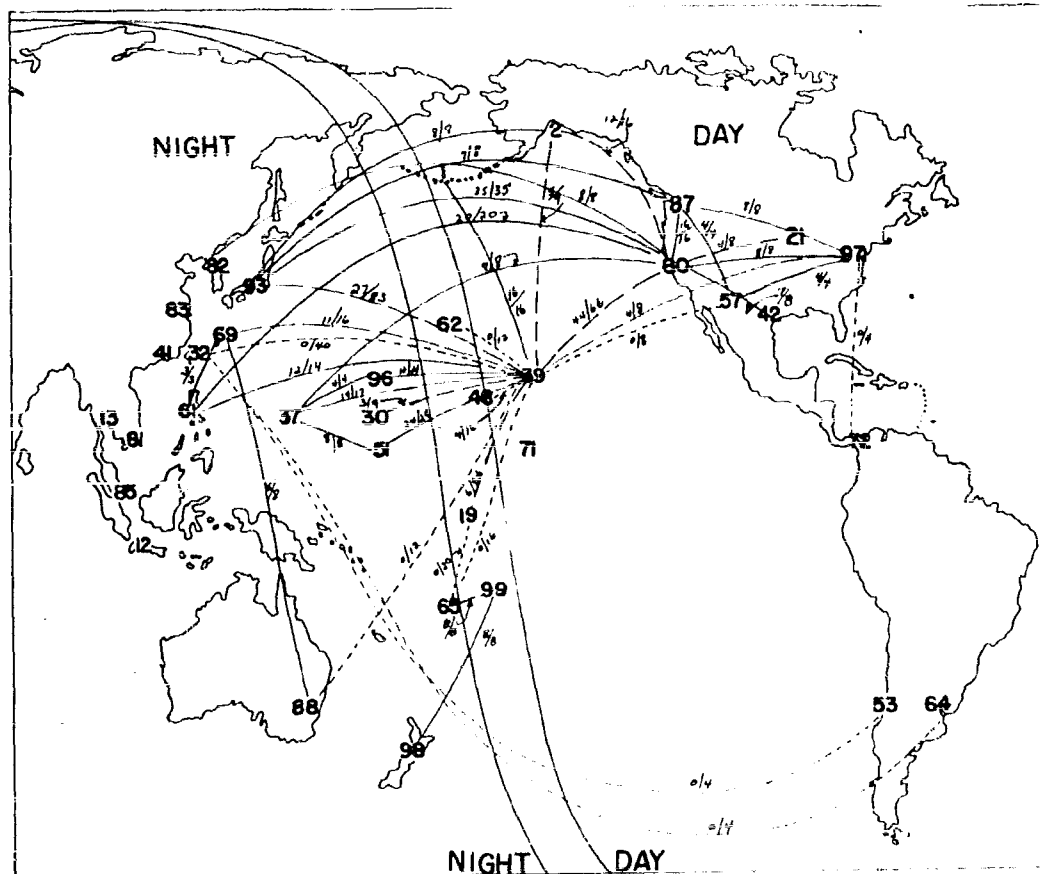
( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1730Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LEO ALAM G	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUADRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IAO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTORRANE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

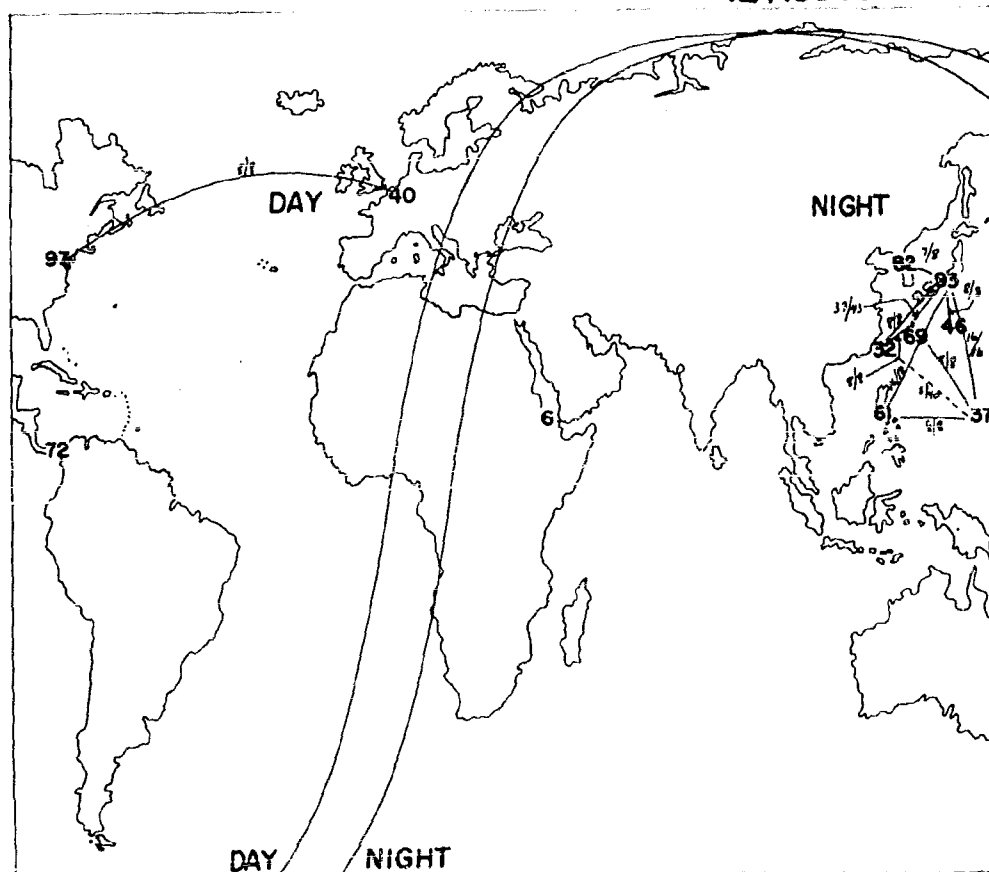
**SECRET**

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1730Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS:

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

KEY TO FREQUENCY UTILITY

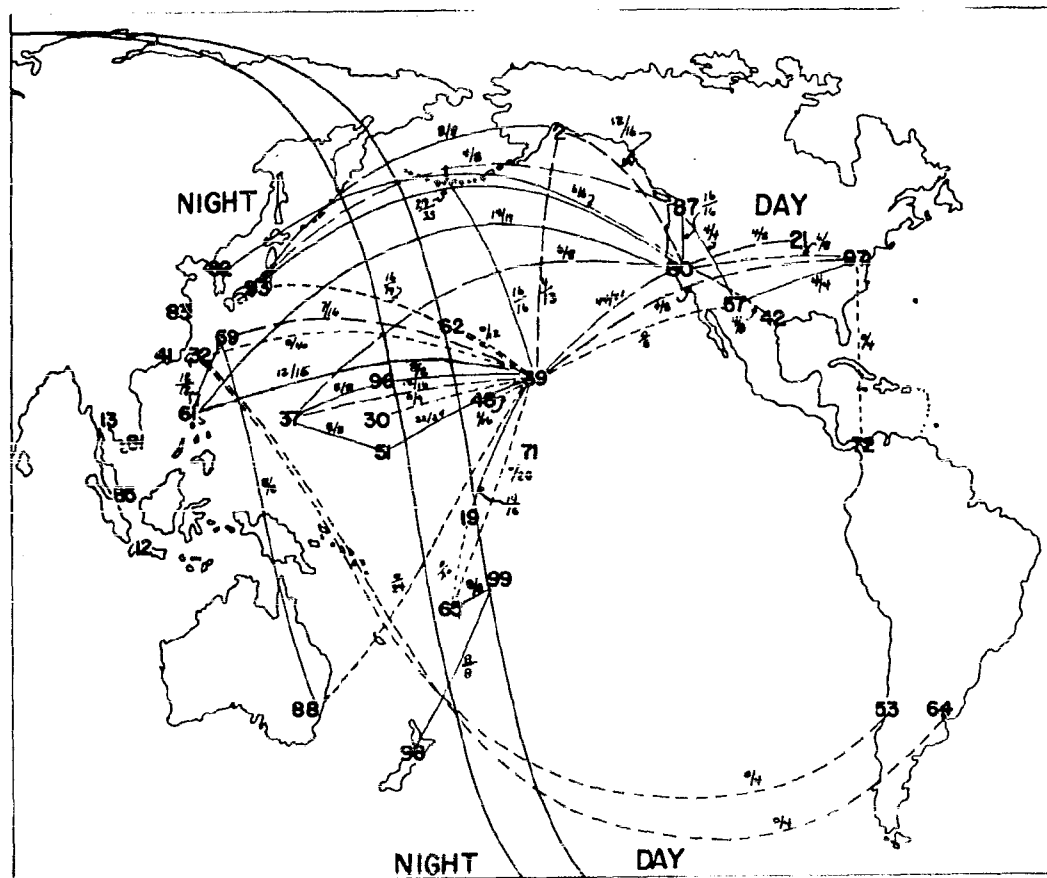
- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————
- ( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1800Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LAS ALAMAS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANGKOK	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

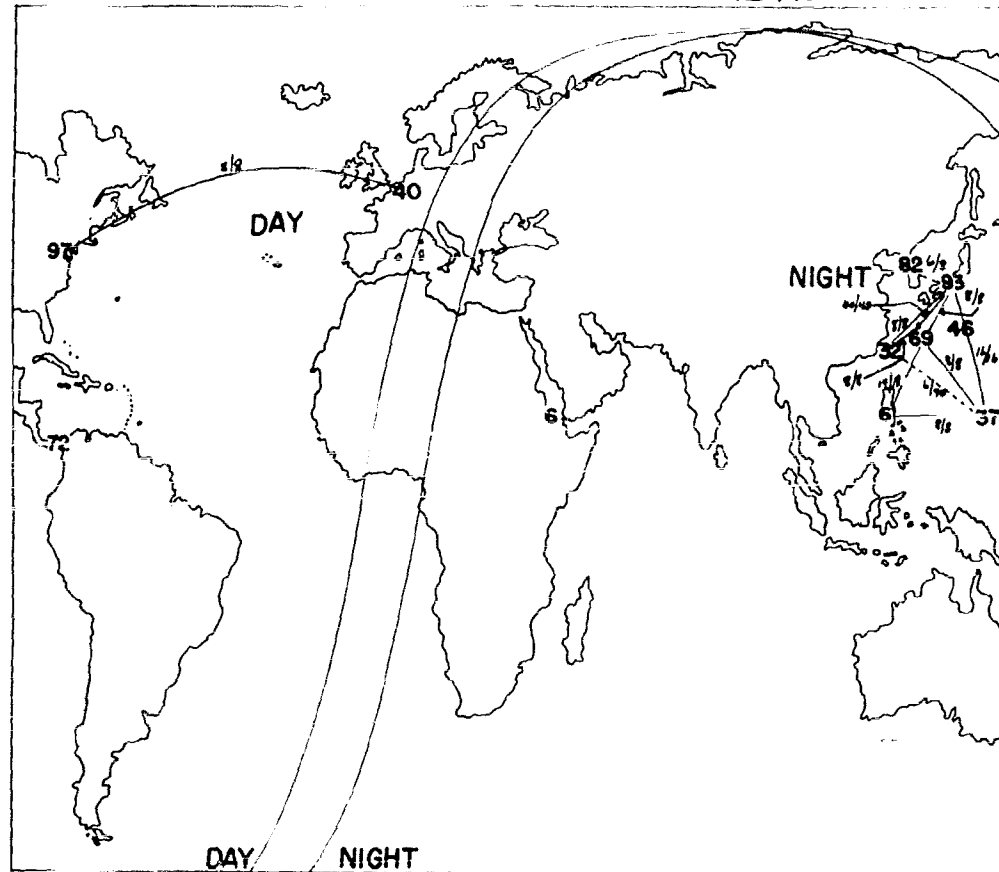
226

Figure 99a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1800Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

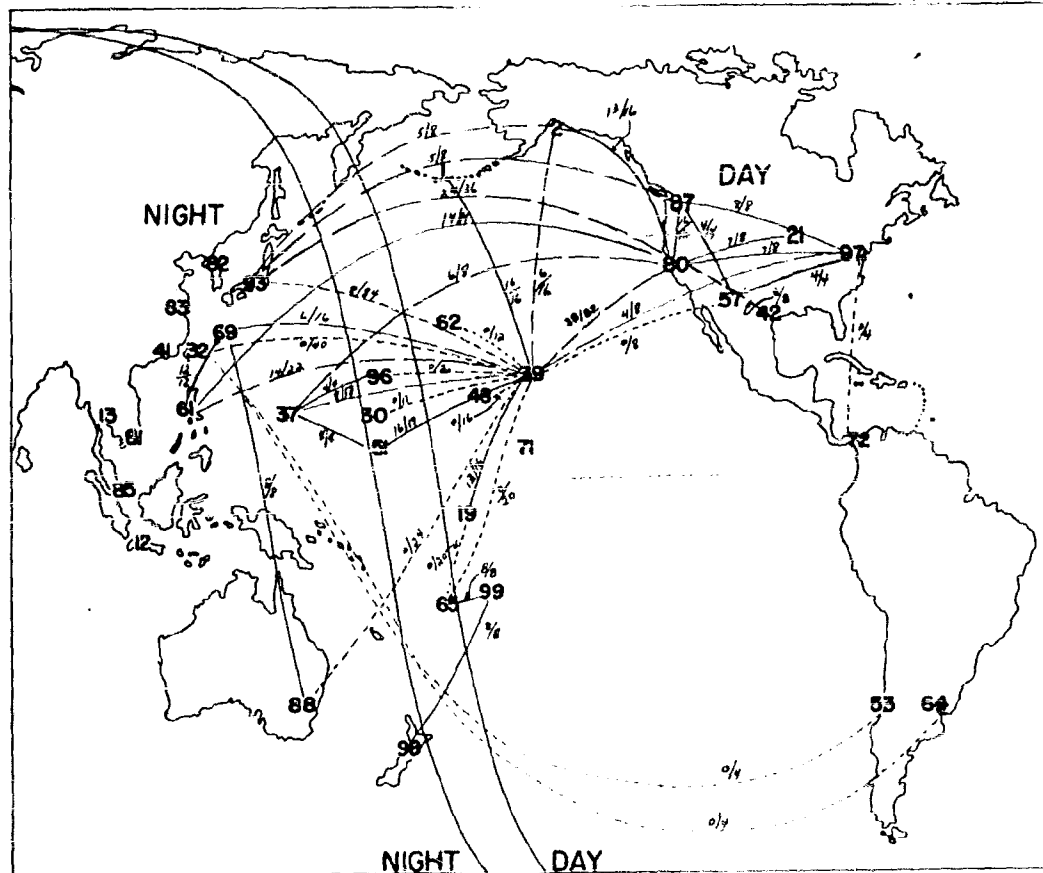
- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————
- ( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1830Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. TWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	63. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

Figure 100a

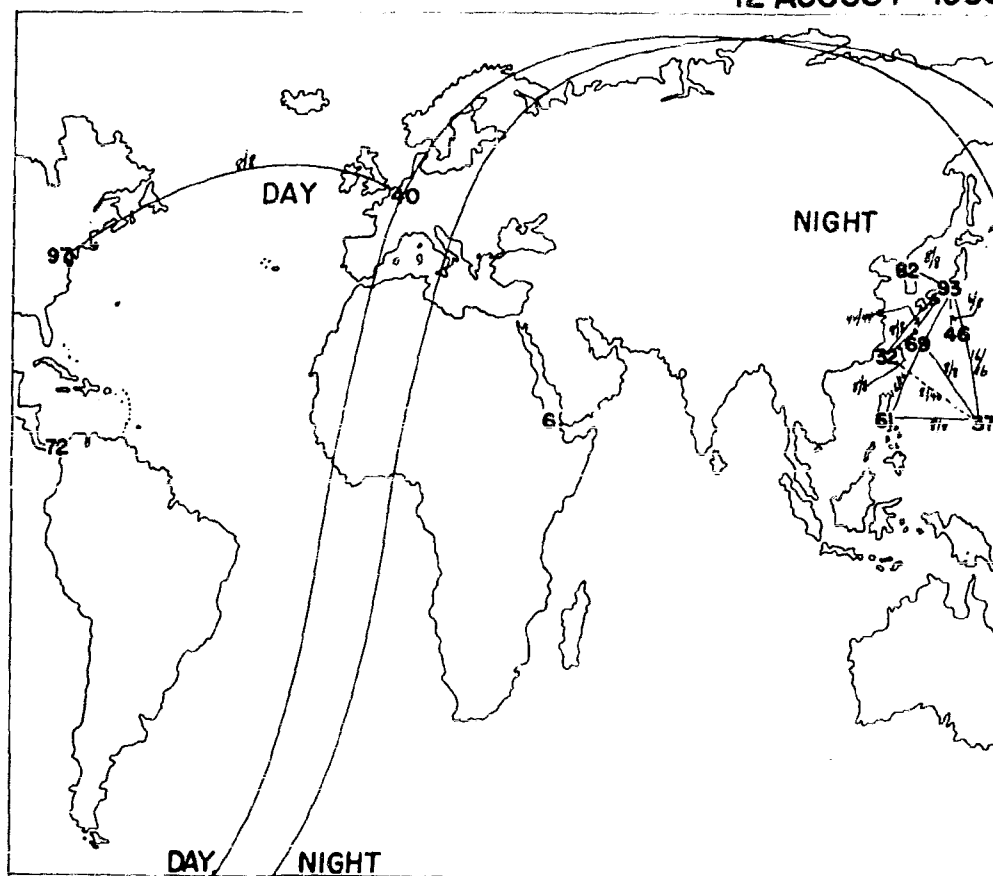
228

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1830Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 60% of frequencies tried were useful: \_\_\_\_\_
- 60% to 100% of frequencies tried were useful: —————

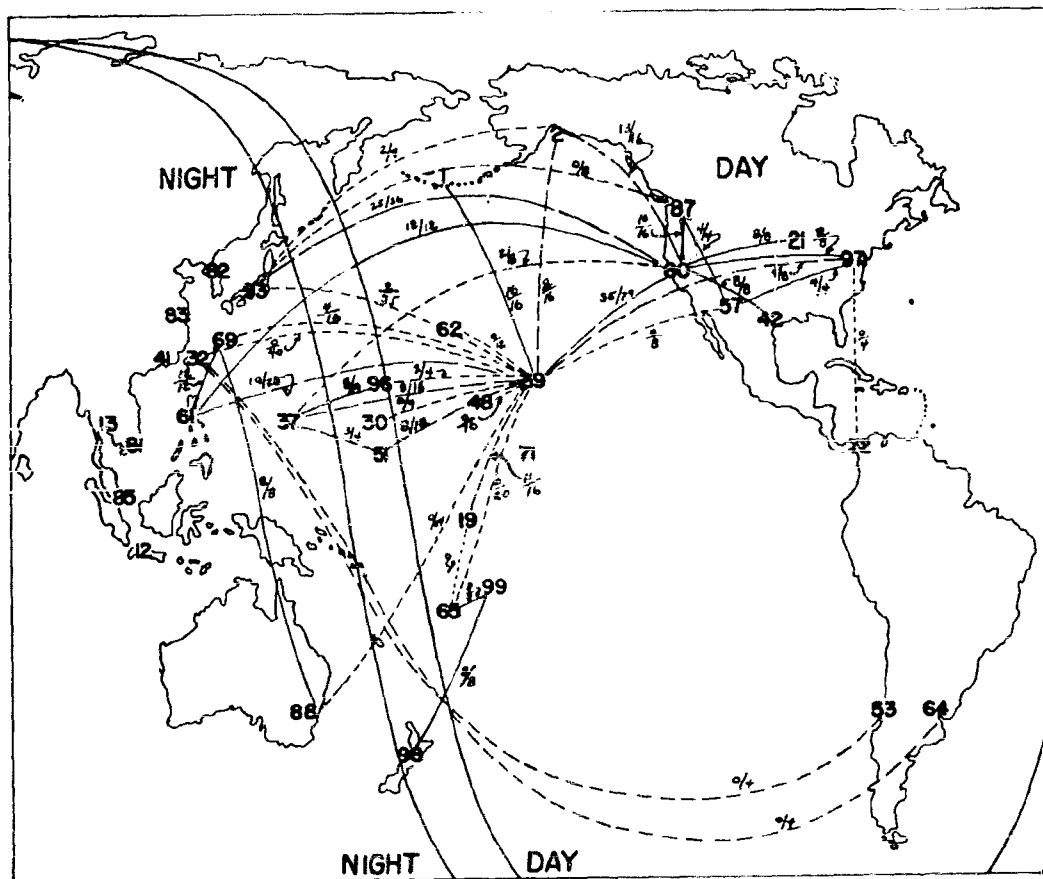
( $\frac{\text{X}}{\text{Y}}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1900Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANOI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

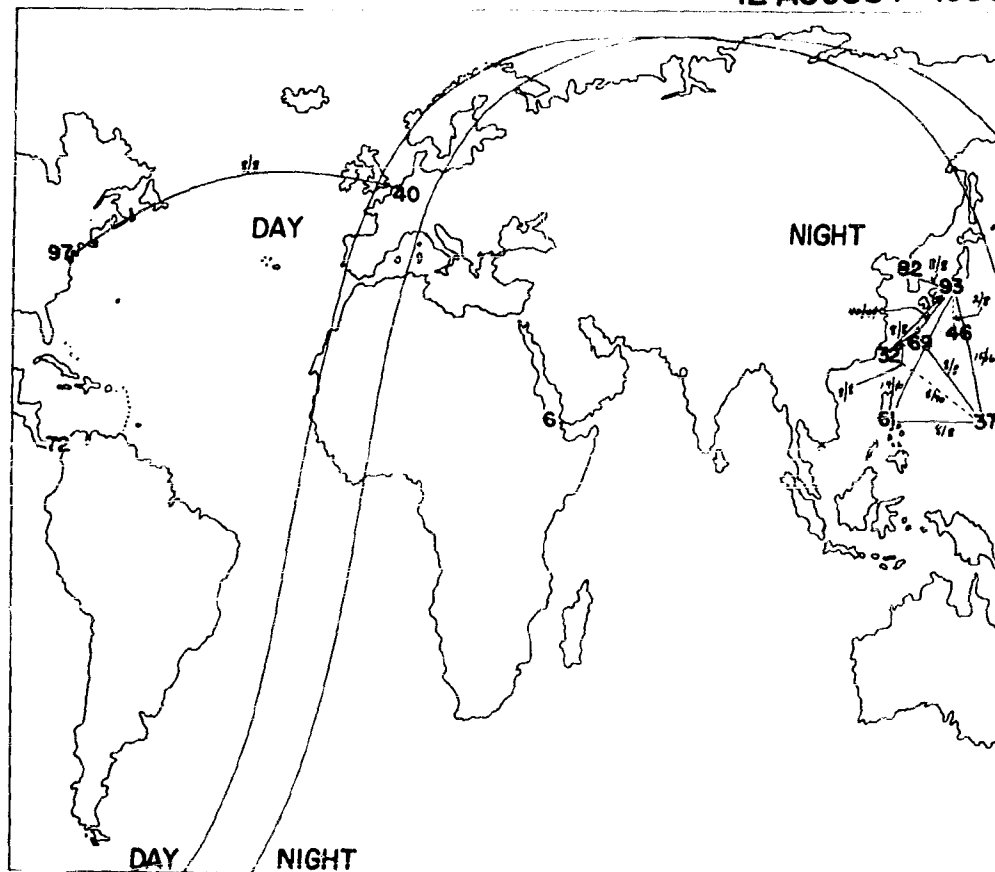
**SECRET**  
230

Figure 101a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1900Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	99. SAMOA IS.

**KEY TO FREQUENCY UTILITY**

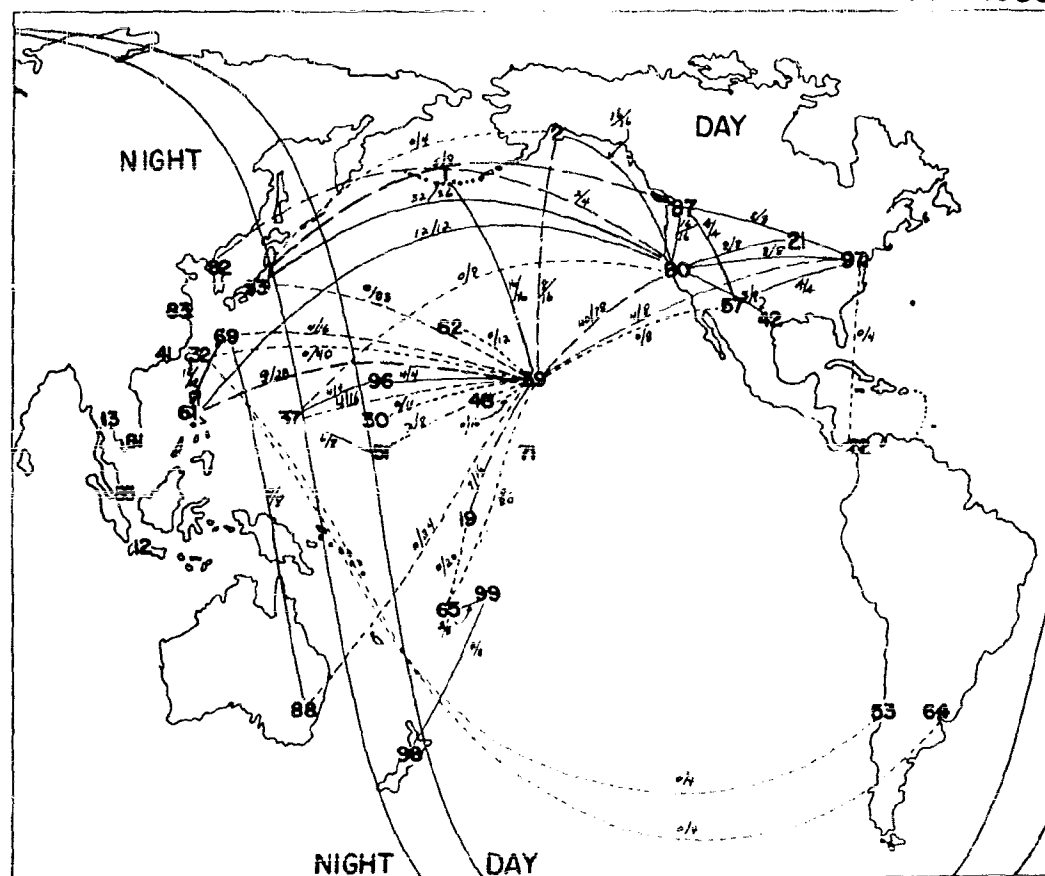
0% to 30% of frequencies tried were useful: - - - - -  
 30% to 80% of frequencies tried were useful: ————  
 80% to 100% of frequencies tried were useful: —————  
 ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1930Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICRANEE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA ORANJA	69. OKINAWA	83. SHANGHAI

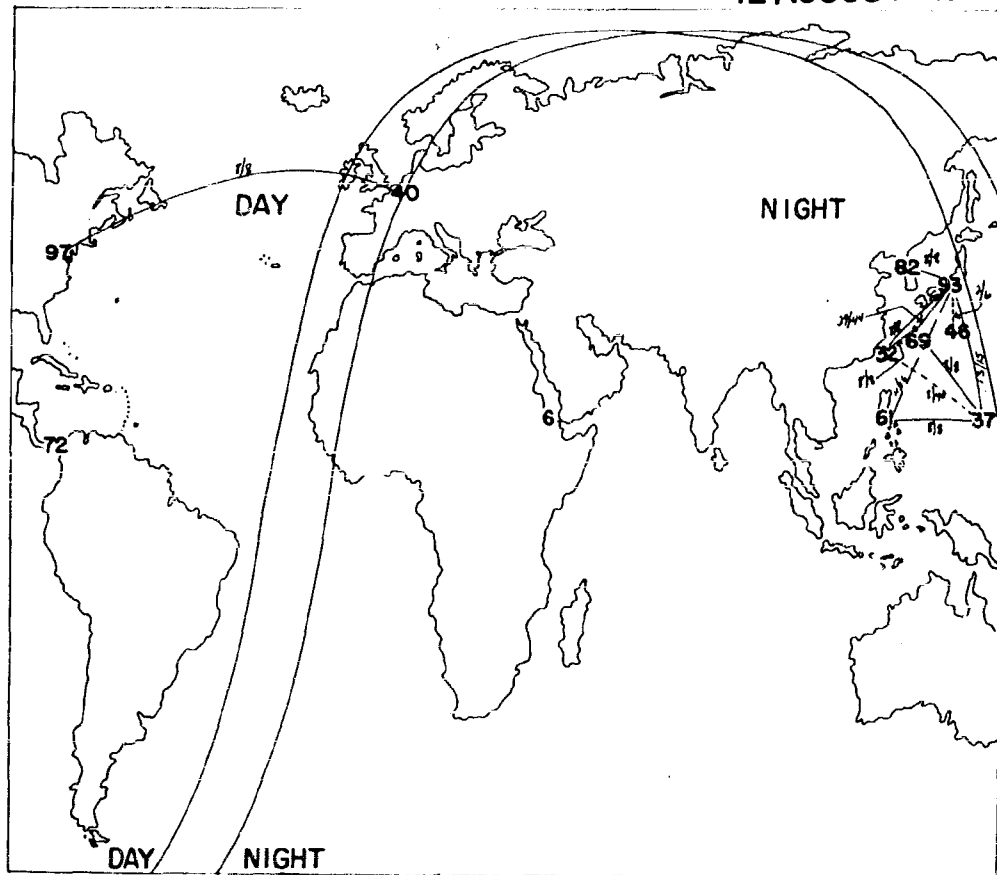
**SECRET**

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 1930Z

12 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

### KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: -----
- 30% to 80% of frequencies tried were useful: -----
- 80% to 100% of frequencies tried were useful: -----

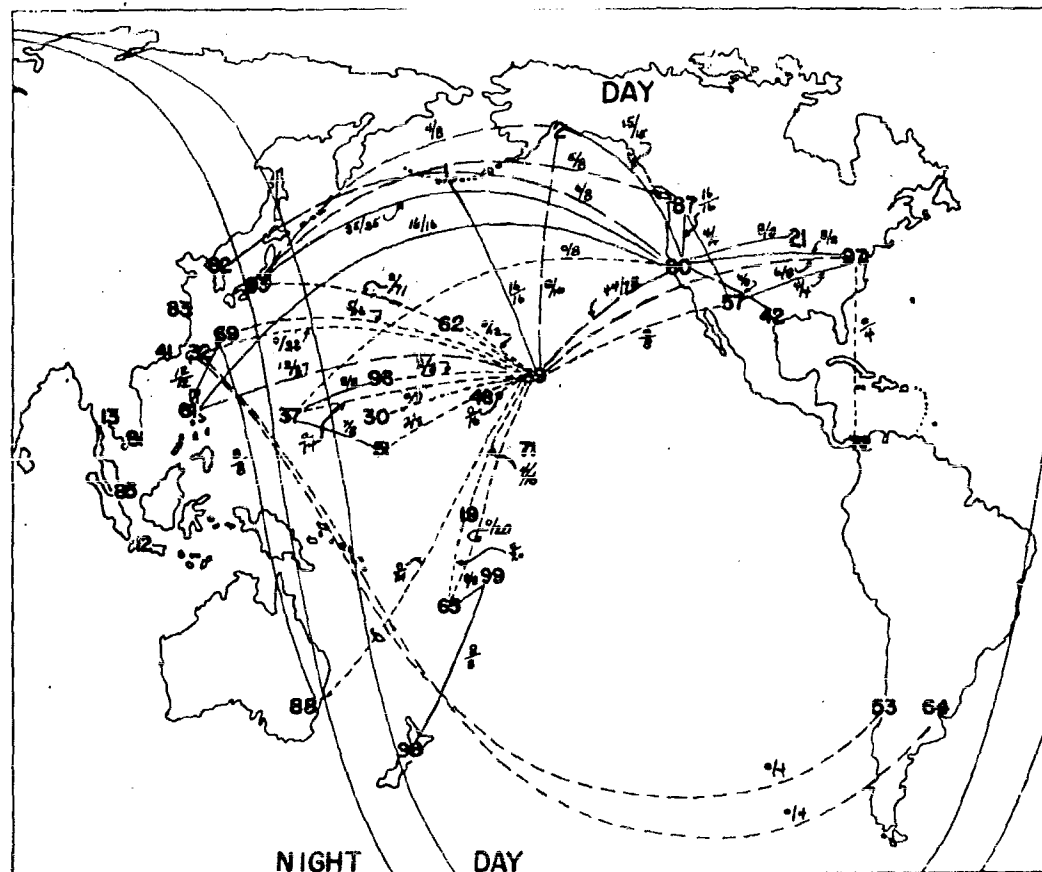
( ) / ( ) = Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

# SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2000Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

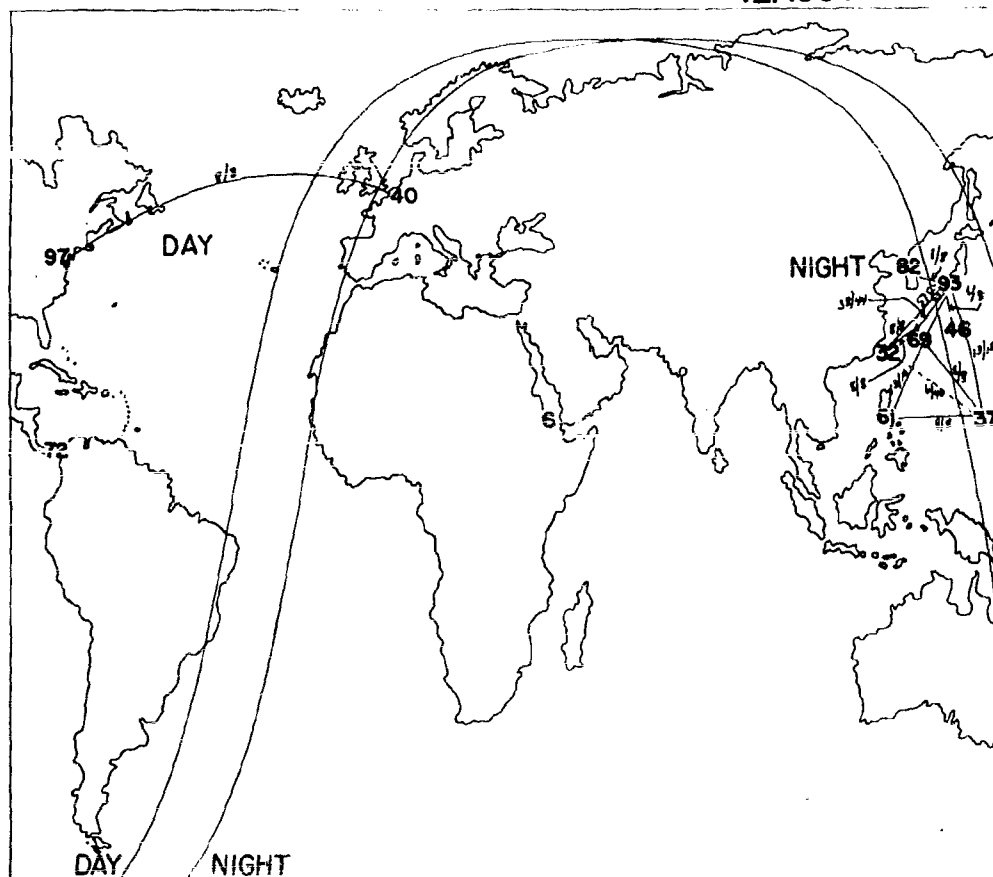
**SECRET**

Figure 103a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2000Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SANTO IS.        |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: — — — — —

80% to 100% of frequencies tried were useful: —————

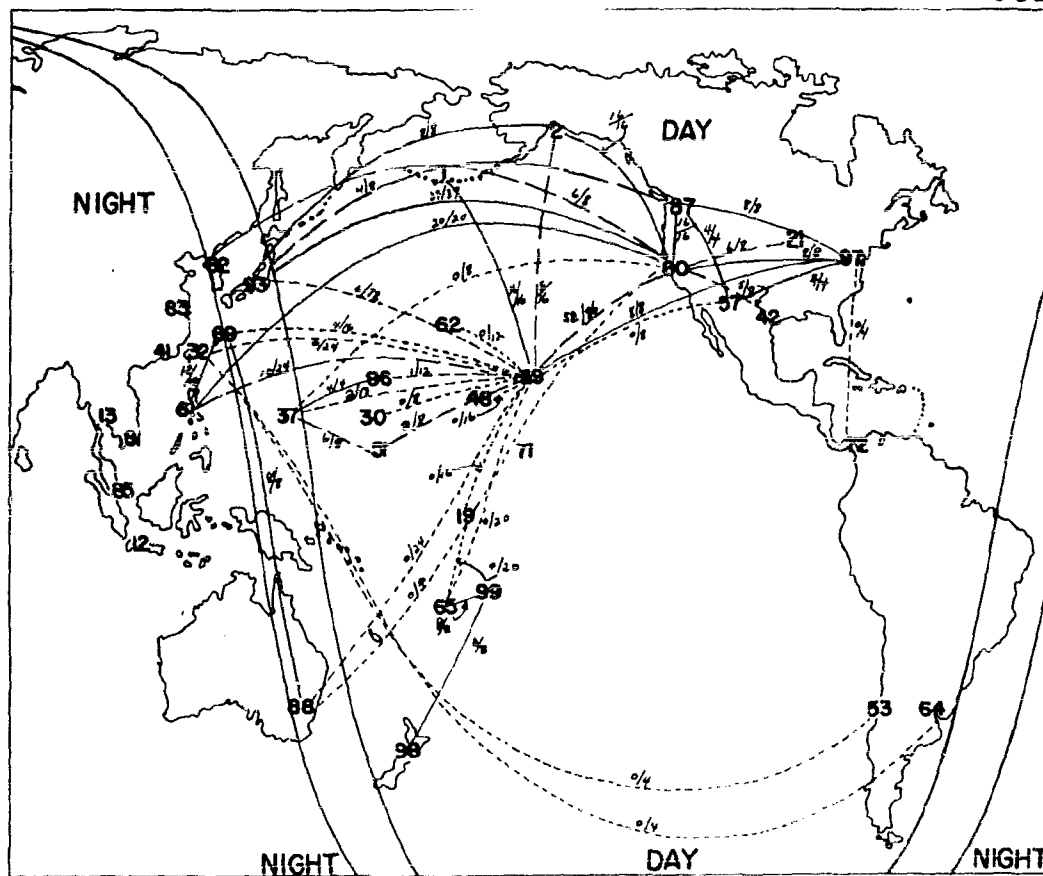
( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: **2030Z**

**12 AUGUST 1958**



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NARDI, FIJI IS.	82. SEERIL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

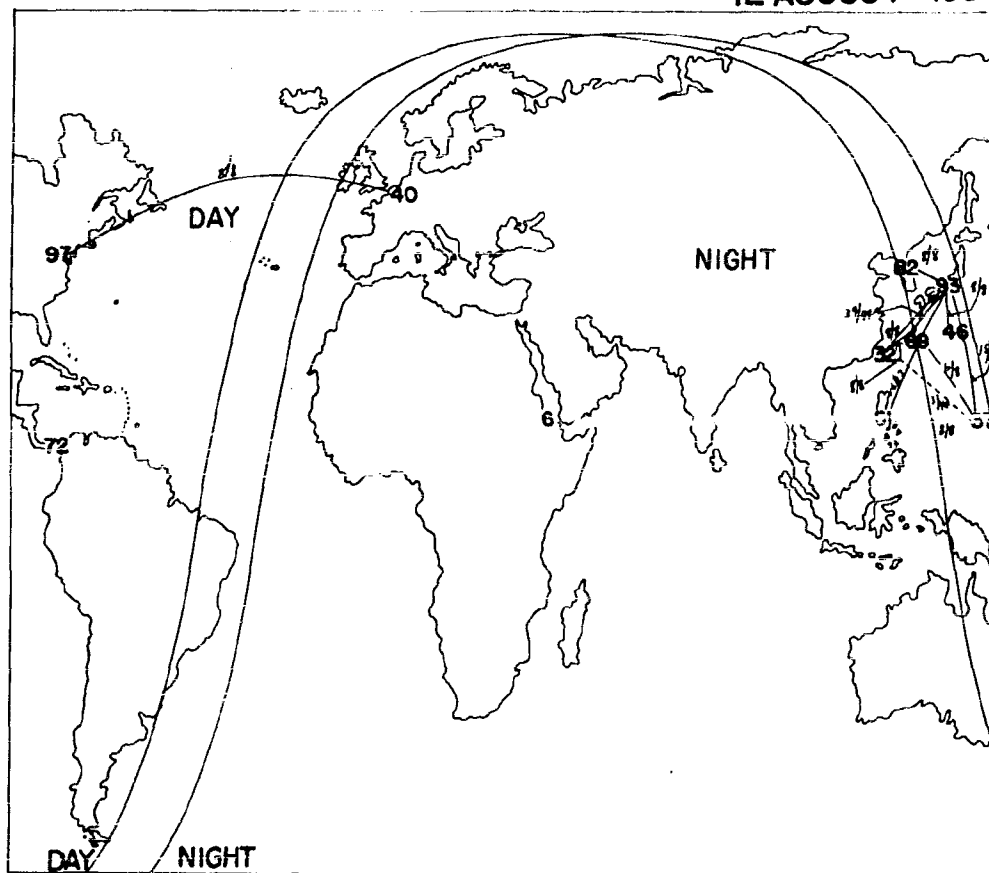
**SECRET**

Figure 104a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2030Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: — — — — —

80% to 100% of frequencies tried were useful: —————

( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)

Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

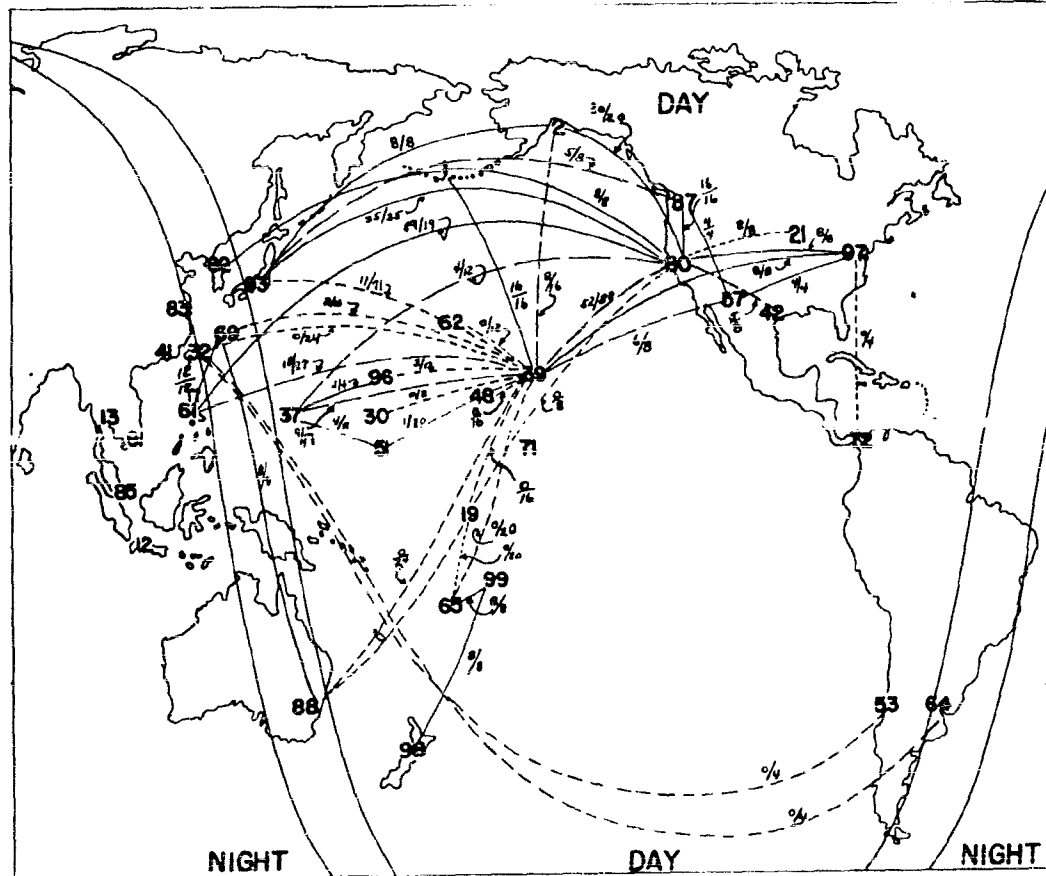
**SECRET**  
 237

Figure 104b

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2100Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

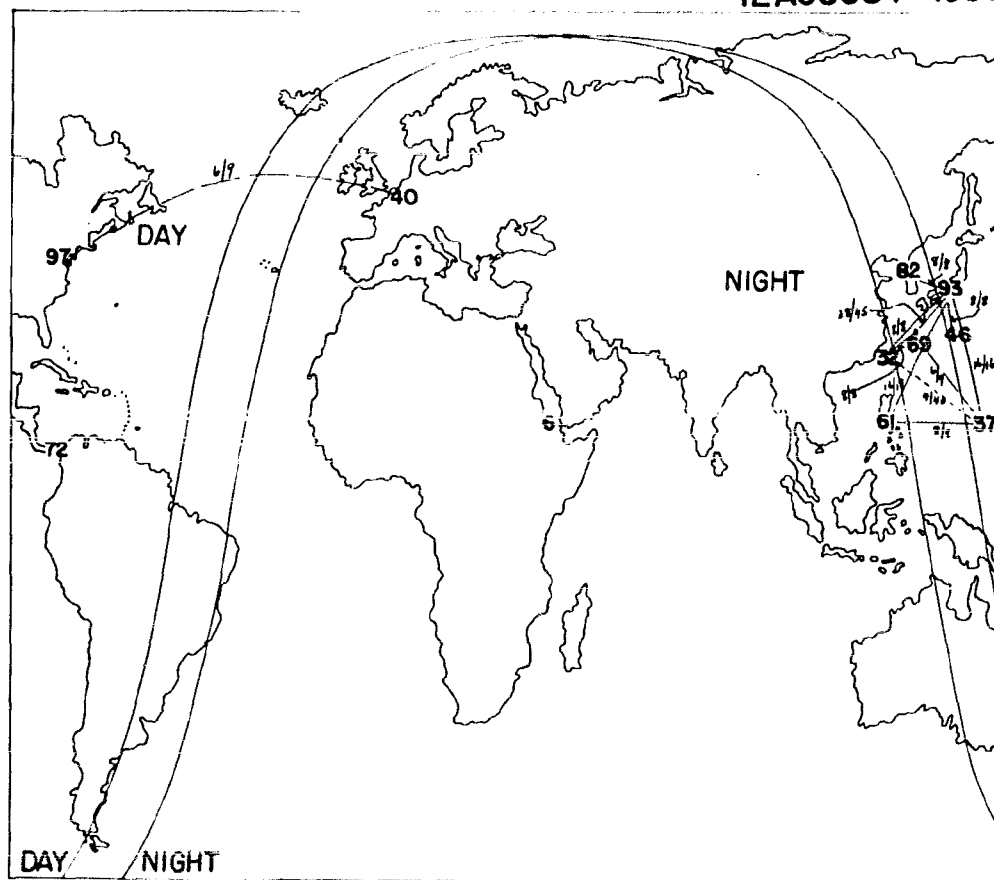
**SECRET**

Figure 105a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2100Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————

( $\frac{\%}{\%}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)

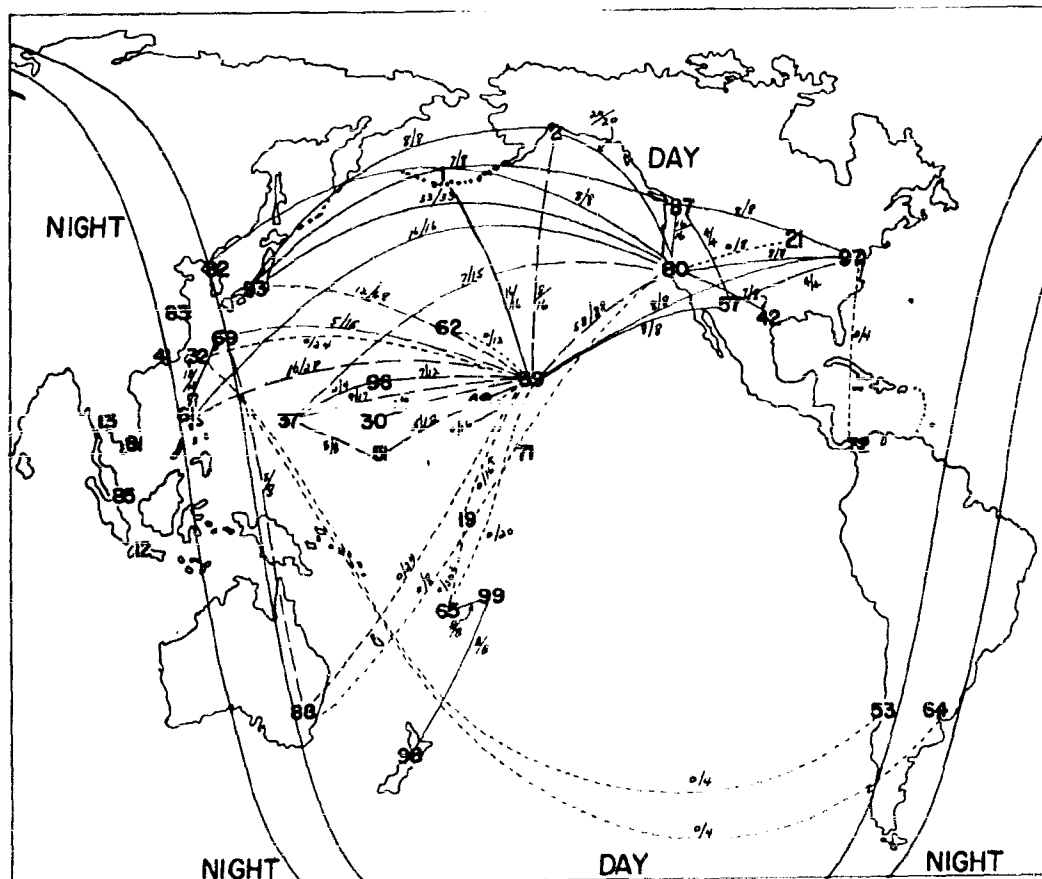
Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: **2130Z**

**12 AUGUST 1958**



KEY TO TERMINAL LOCATIONS

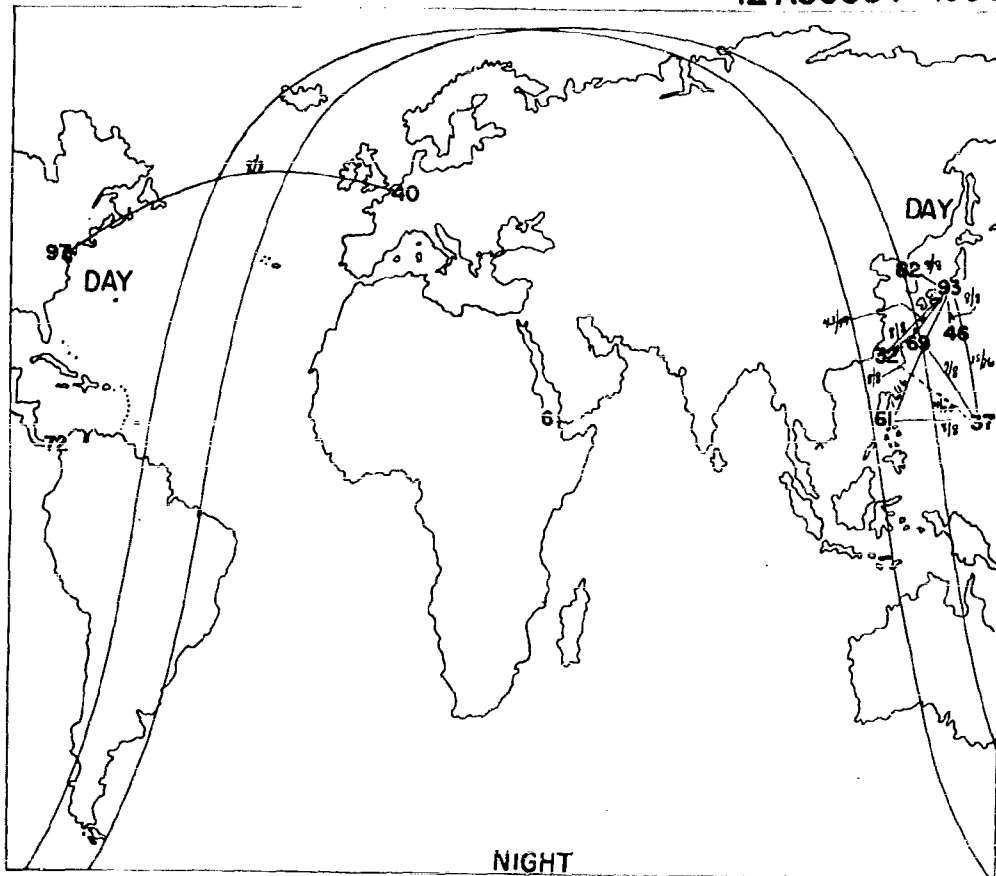
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. TWO JIMS	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGUANTE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2130Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: -----
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

( / ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**  
 241

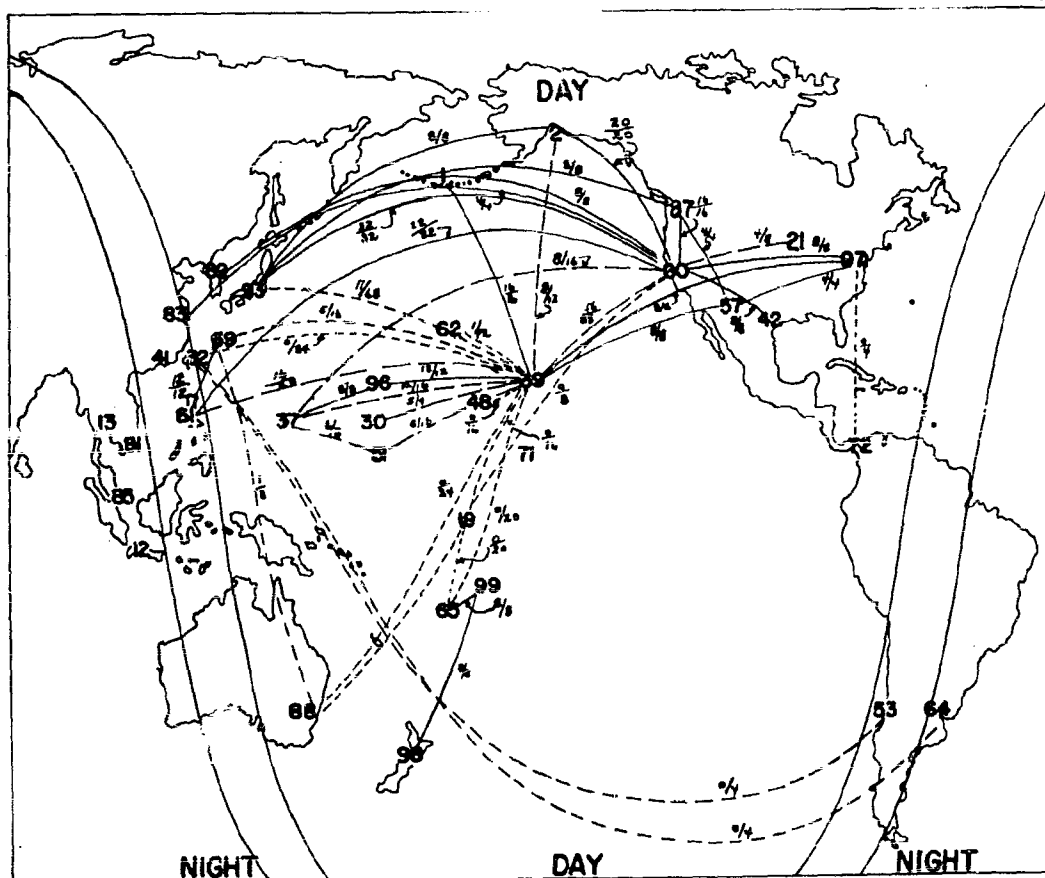
Figure 106b

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 2200Z

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

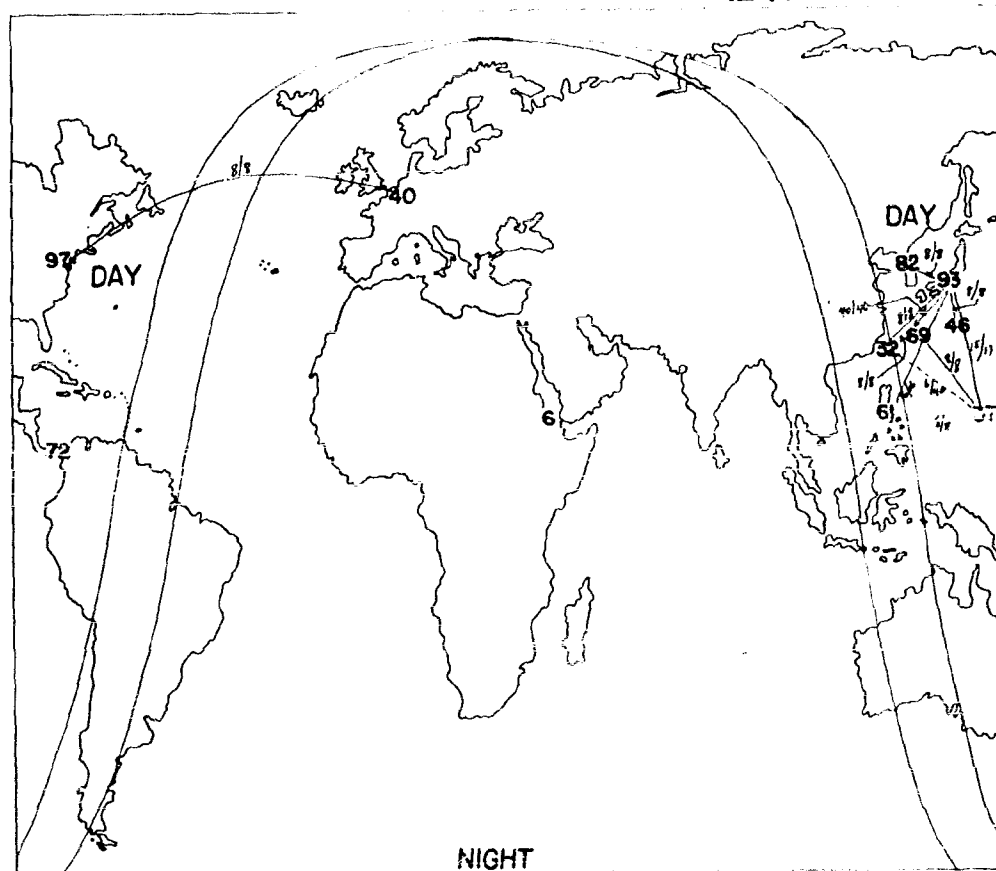
- |                |                |                      |                    |                    |
|----------------|----------------|----------------------|--------------------|--------------------|
| 1. ADEL        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS     | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA         | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY         | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTIGRANDE    | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NADI, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA        | 83. SHANGHAI       |

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2200Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: ————

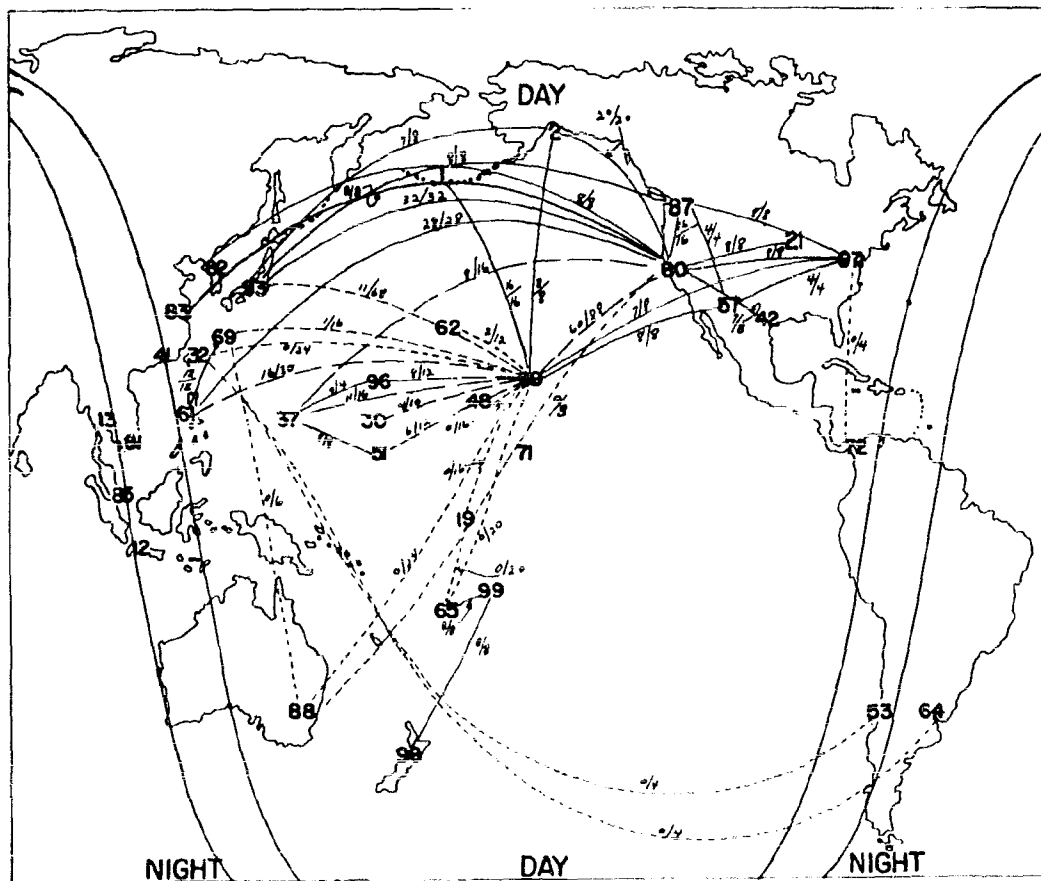
( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour (interval depicted.))

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: **2230Z**

**12 AUGUST 1958**



KEY TO TERMINAL LOCATIONS

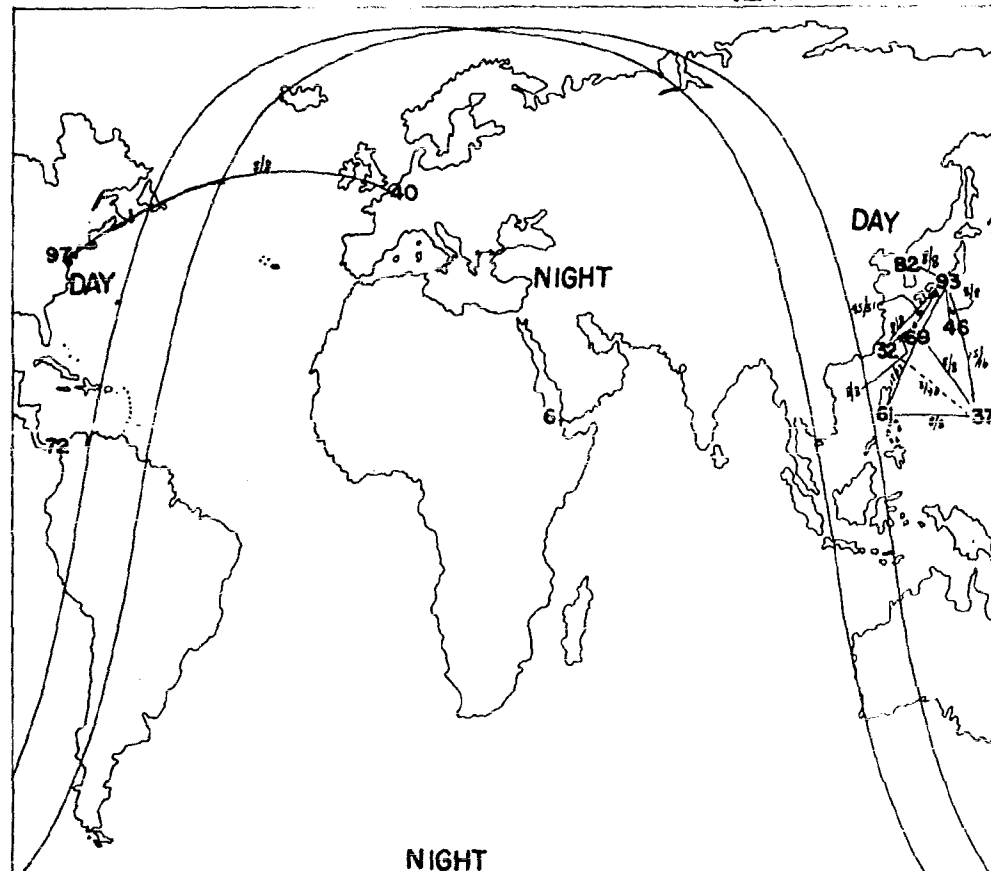
- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAX        | 21. CHICAGO    | 41. HONGKONG         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 77. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTICRANEE     | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANDI, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 84. SHANGHAI       |

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: **2230Z**

**12 AUGUST 1958**



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

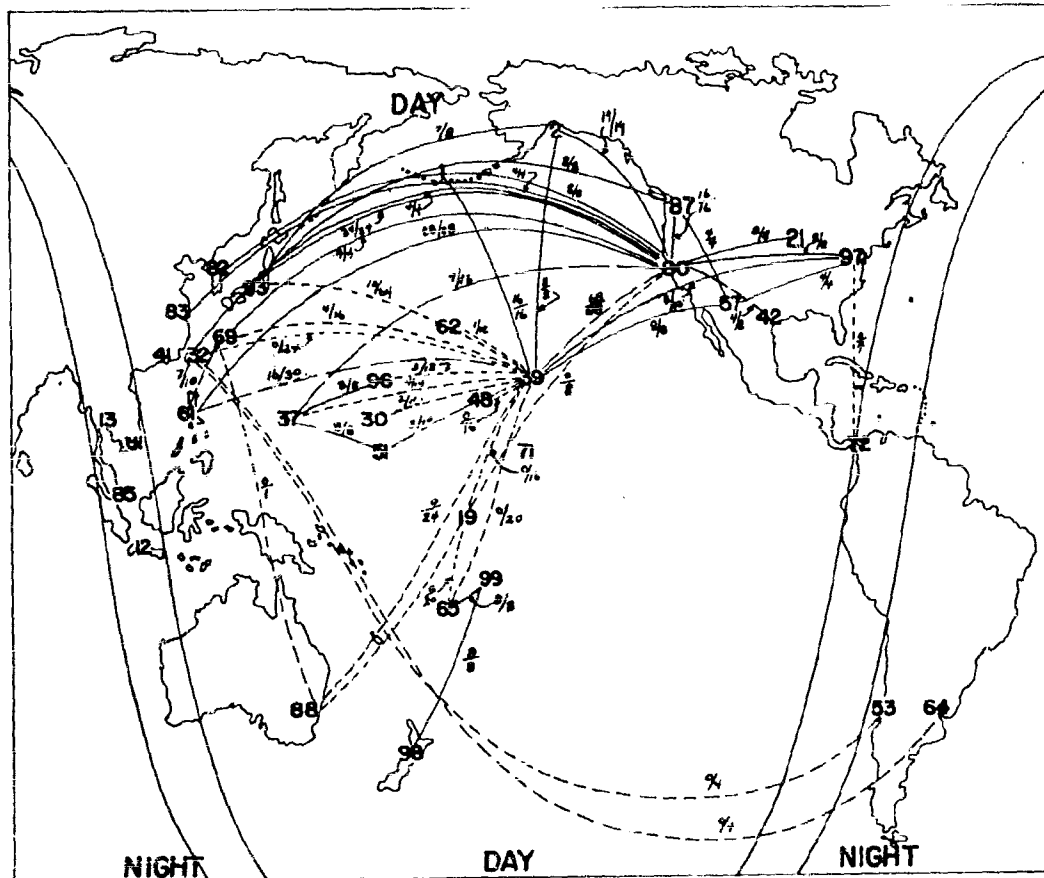
**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————
- ( ) - Numerator of fraction is 4 x (number of usable frequency hours,  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**  
**TIME INTERVAL CENTERED ON: 2300Z**

12 AUGUST 1958



KEY TO TERMINAL LOCATIONS

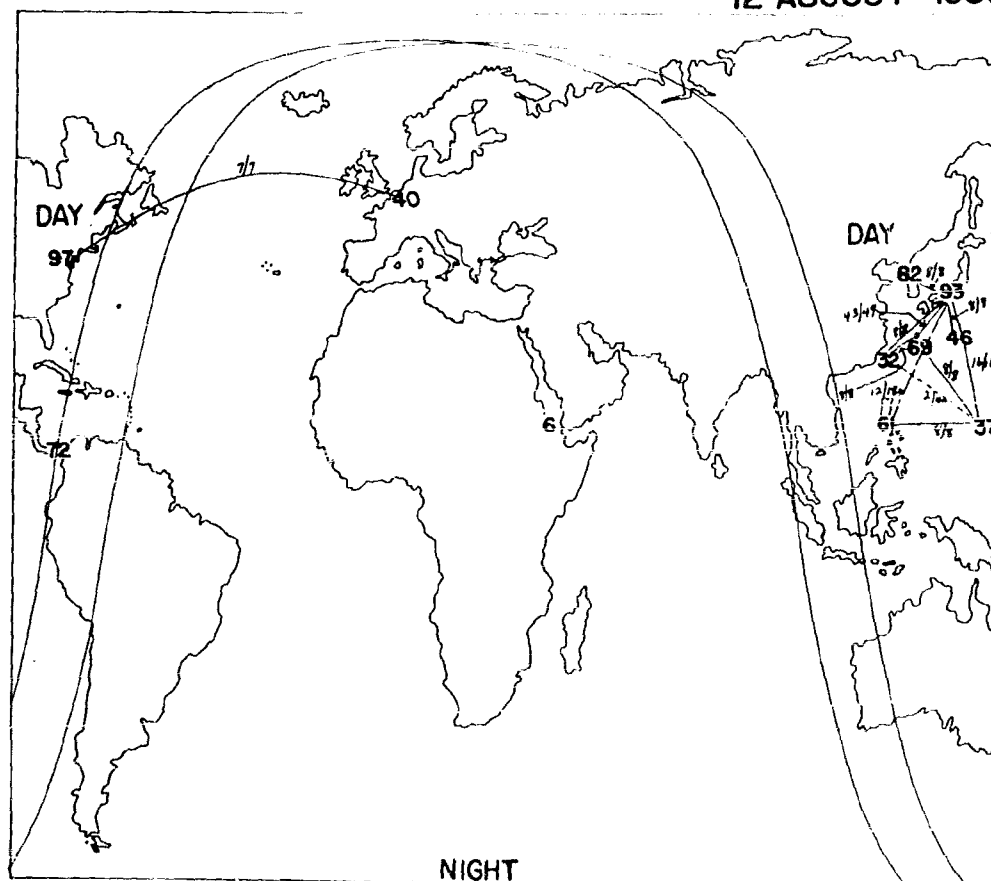
1. ADAK	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANTA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 2300Z

12 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     | 99. SAMOA IS.        |

**KEY TO FREQUENCY UTILITY**

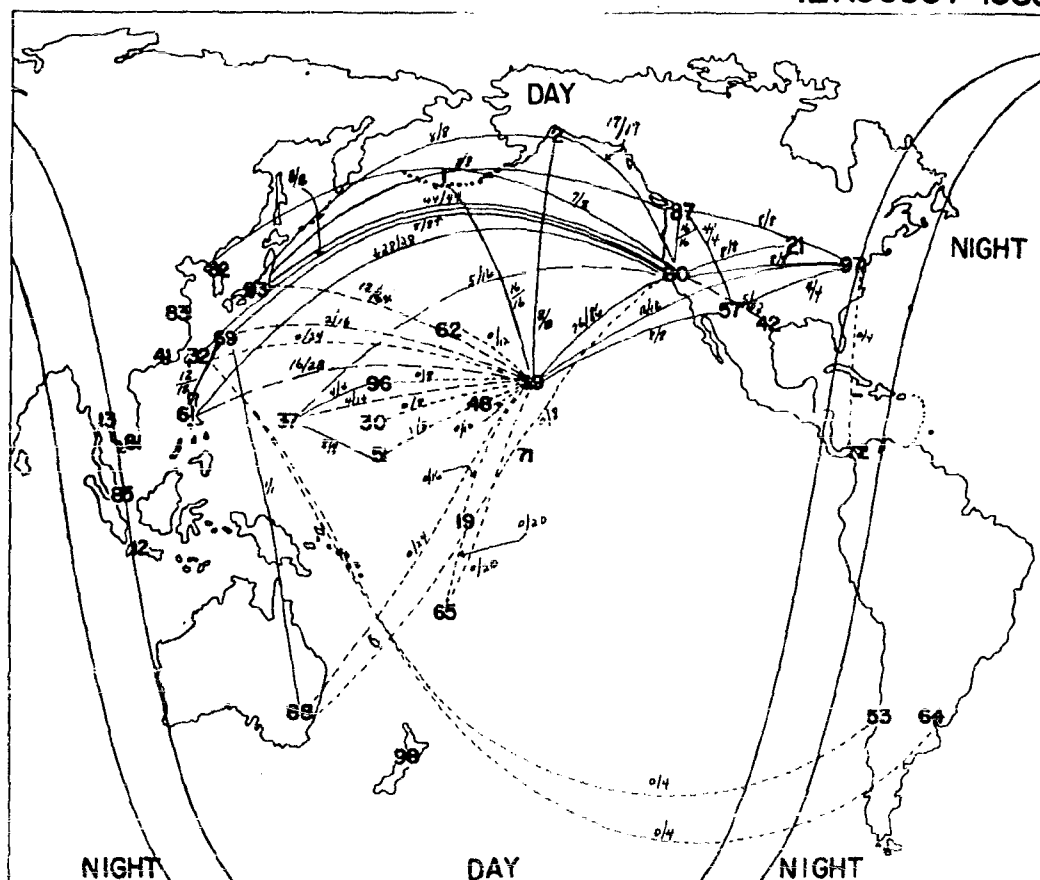
- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: - - - - -
- 80% to 100% of frequencies tried were useful: - - - - -
- ( ) - Numerator of fraction is 4 x (number of usable frequency hours.)
- Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: **2330Z**

**12 AUGUST 1958**



KEY TO TERMINAL LOCATIONS

1. ADAM	21. CHICAGO	41. HONKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICHAUNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. REIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANNHAI

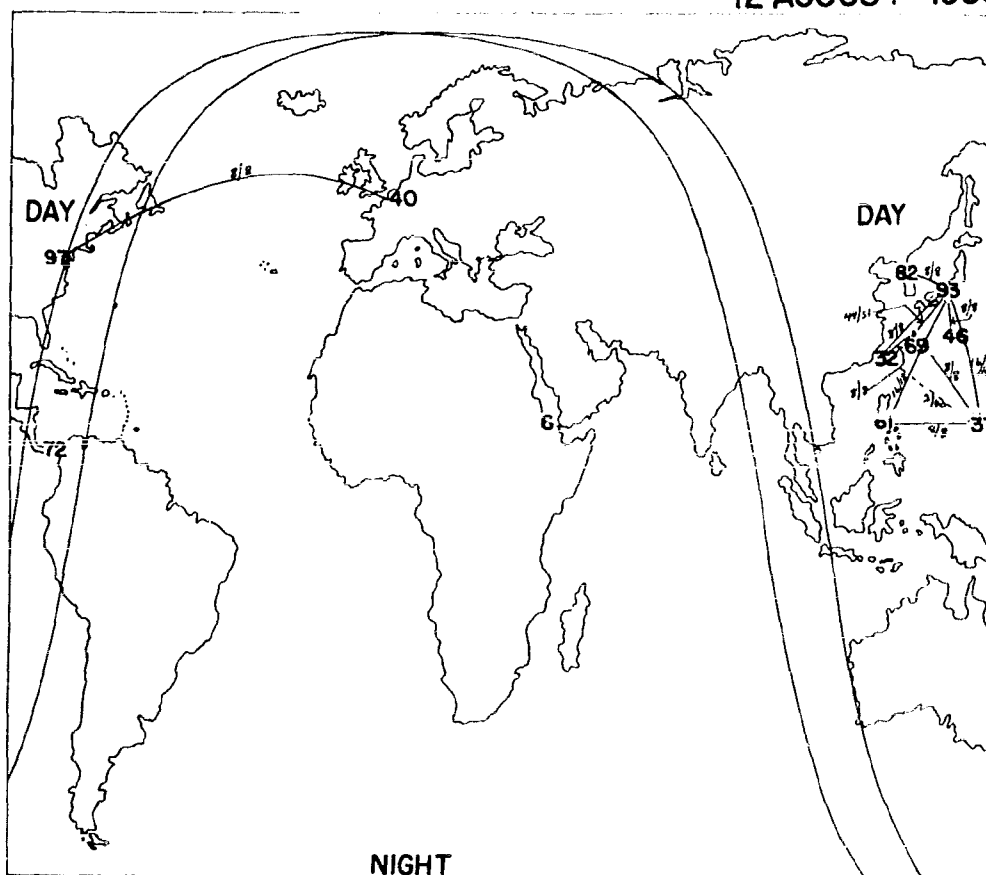
**SECRET**

Figure 110a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON : **2330Z**

**12 AUGUST 1958**



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————

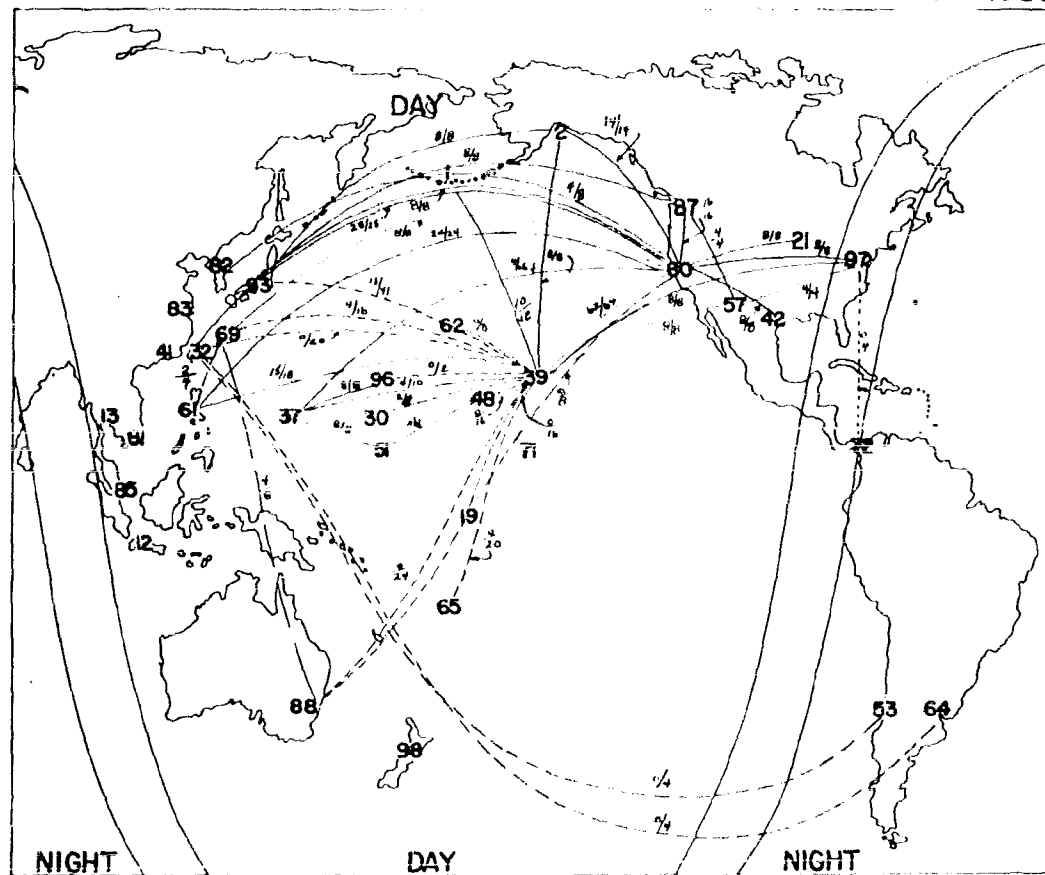
( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depleted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0000Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS:

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENISETUK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MILWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

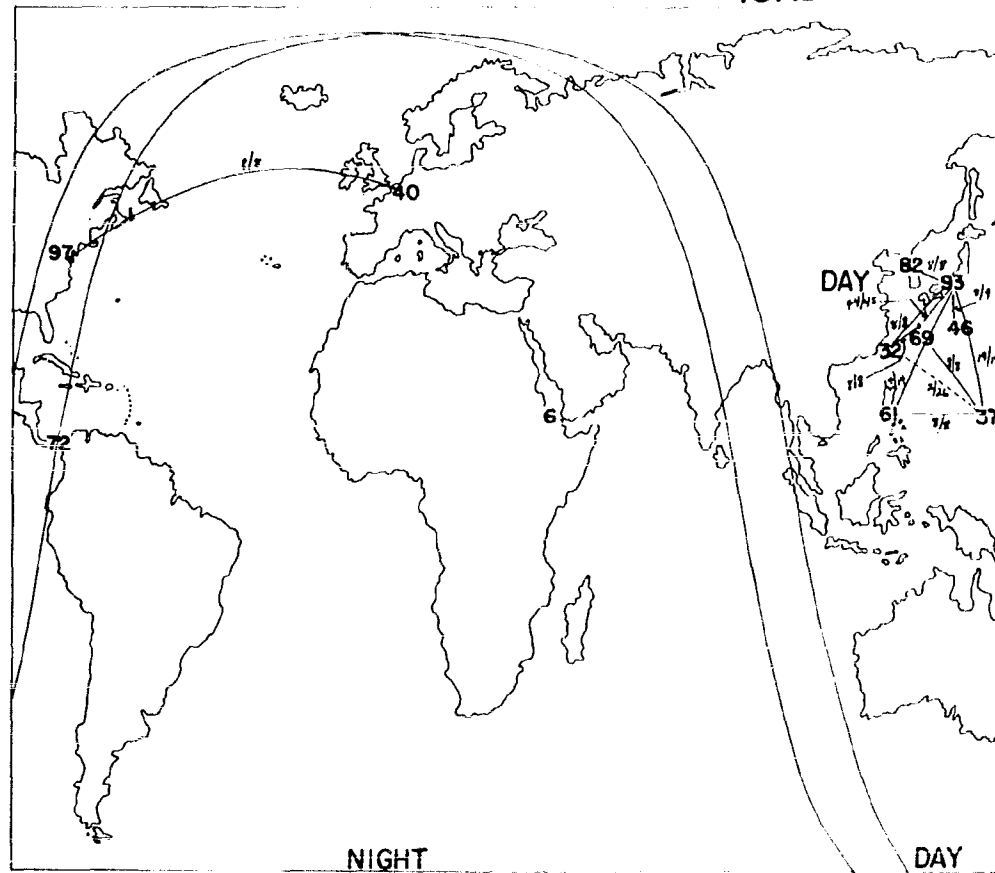
**SECRET**

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 0000Z

13 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

### KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: -----
- 30% to 80% of frequencies tried were useful: -----
- 80% to 100% of frequencies tried were useful: -----

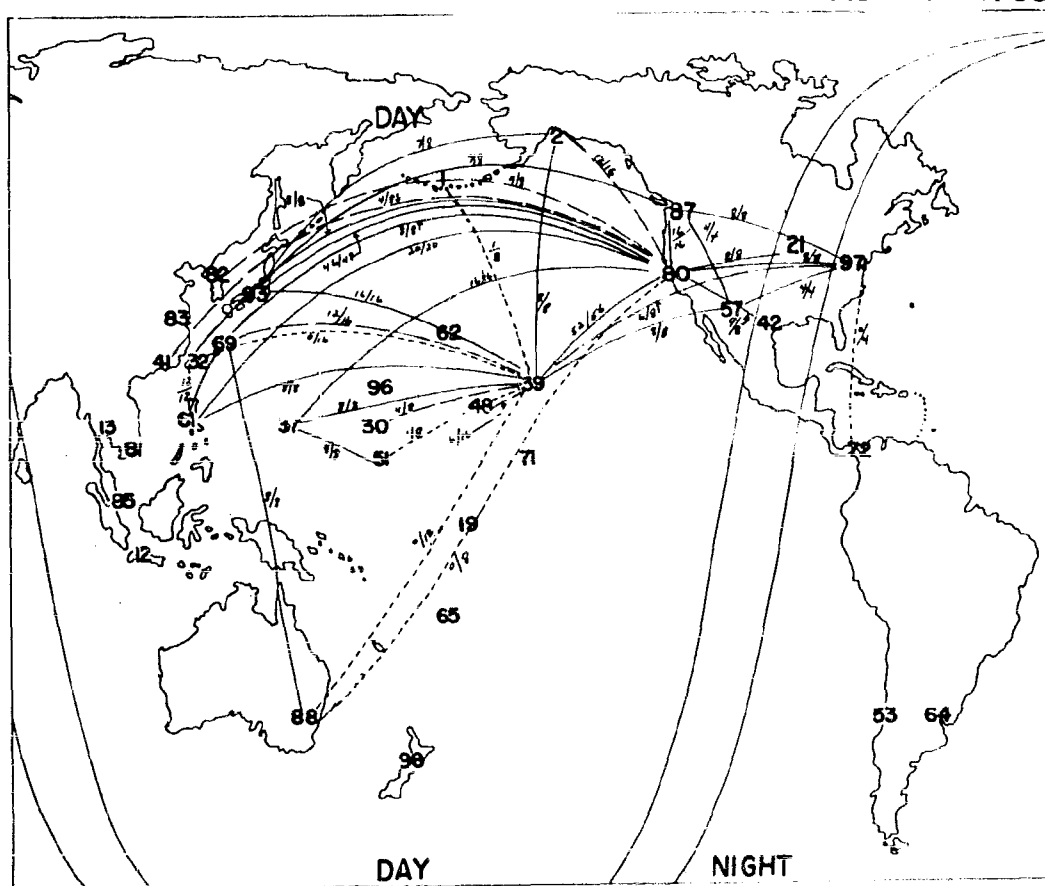
( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

# SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0100Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

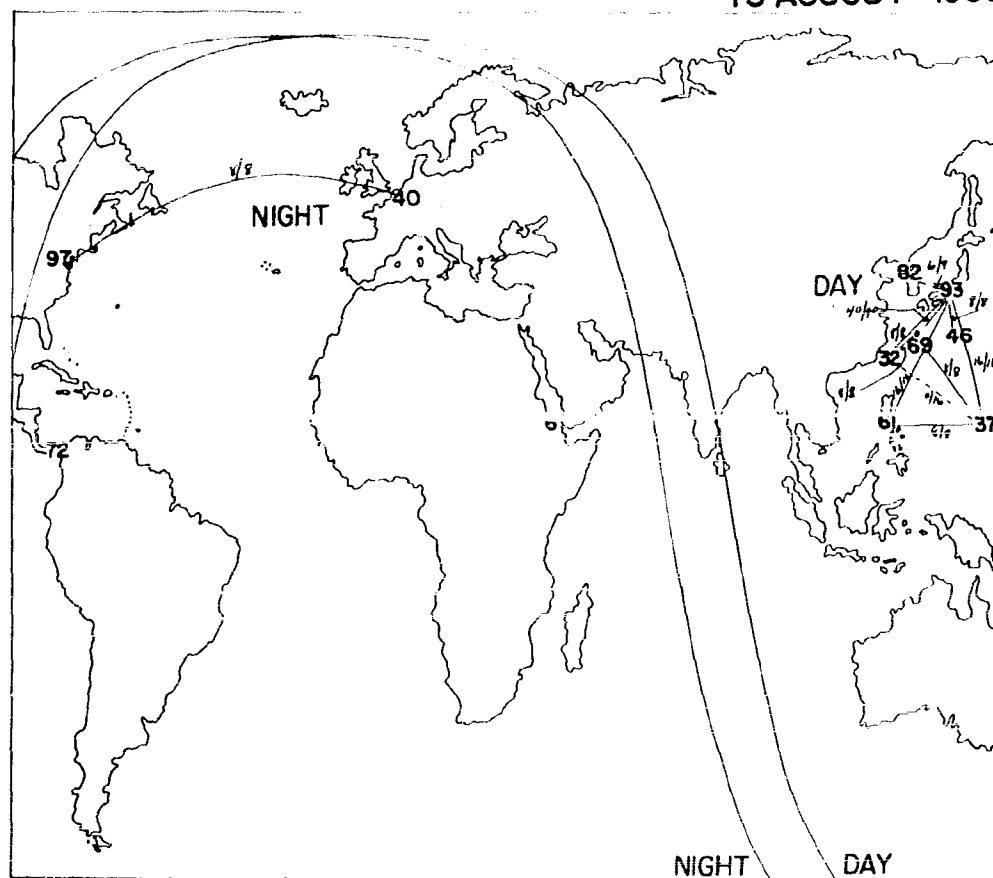
1. ADAM	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICRANIE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANOI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0100Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS:

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 60% of frequencies tried were useful: ————
- 60% to 100% of frequencies tried were useful: —————
- ( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

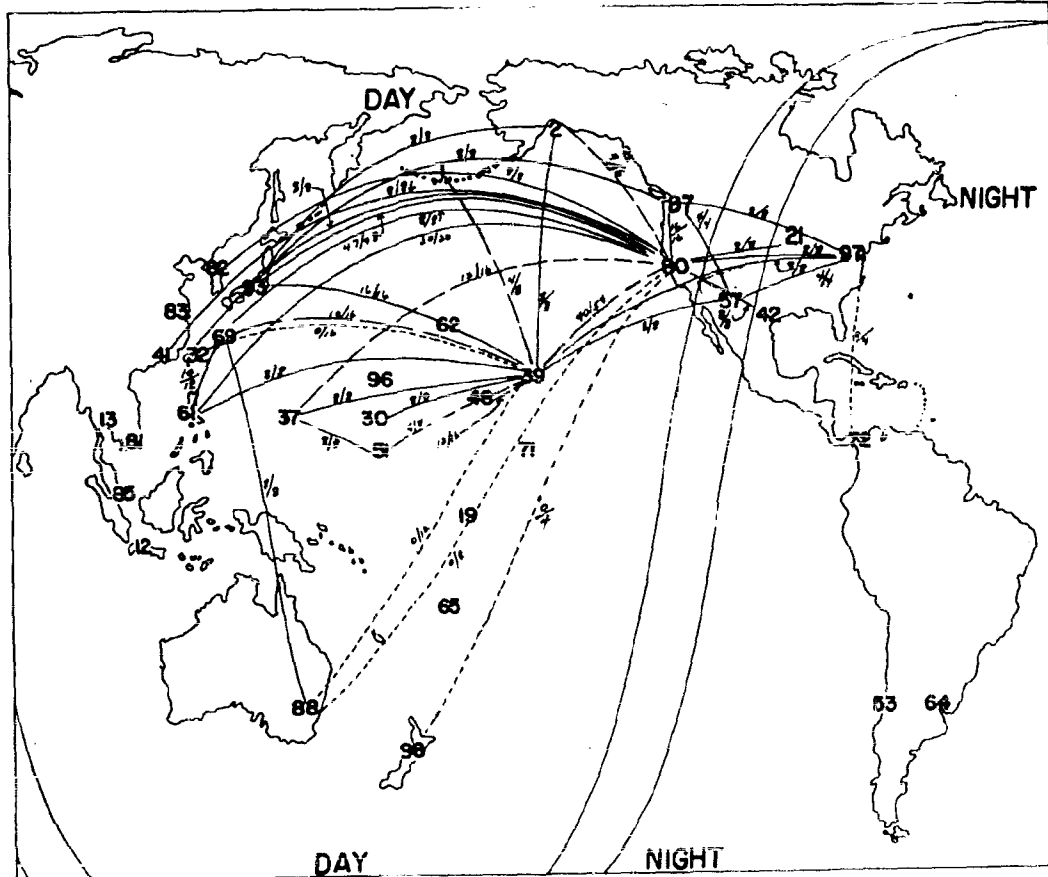
253

Figure 112b

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0200Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

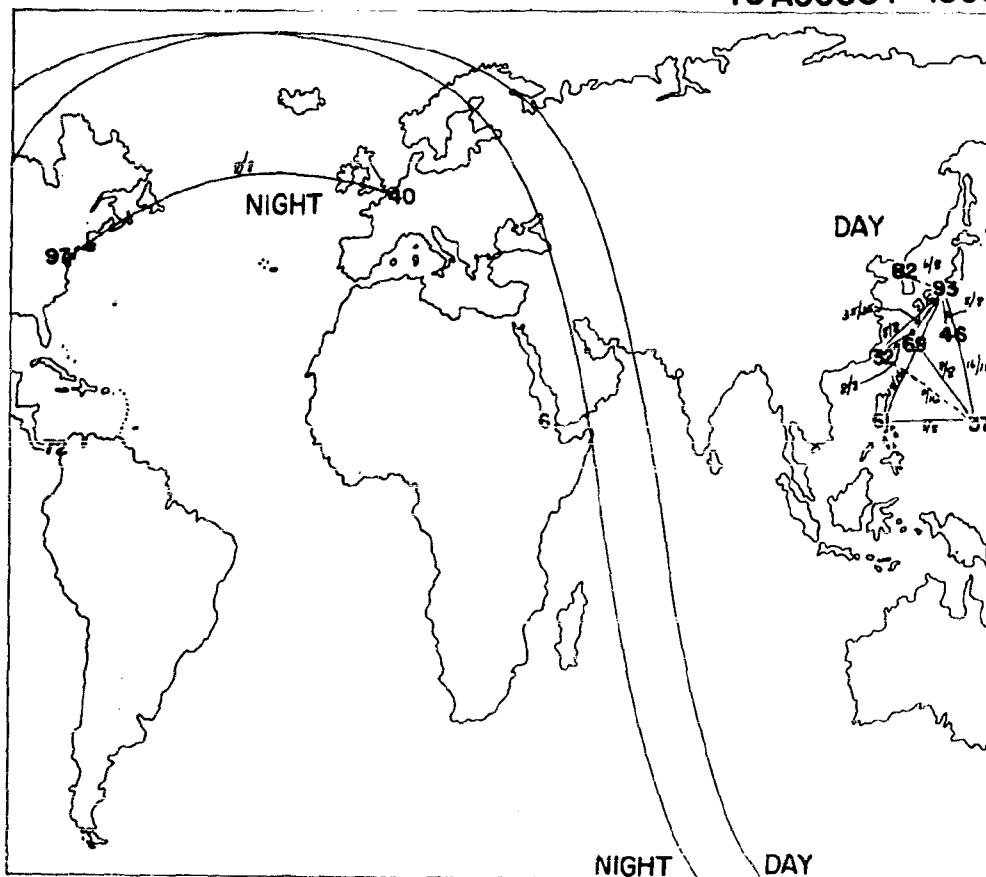
1. ADAM	21. CHICAGO	41. HONOLULU	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANGA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0200Z

13 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -

30% to 80% of frequencies tried were useful: - - - - -

80% to 100% of frequencies tried were useful: - - - - -

( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)

Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

**SECRET**

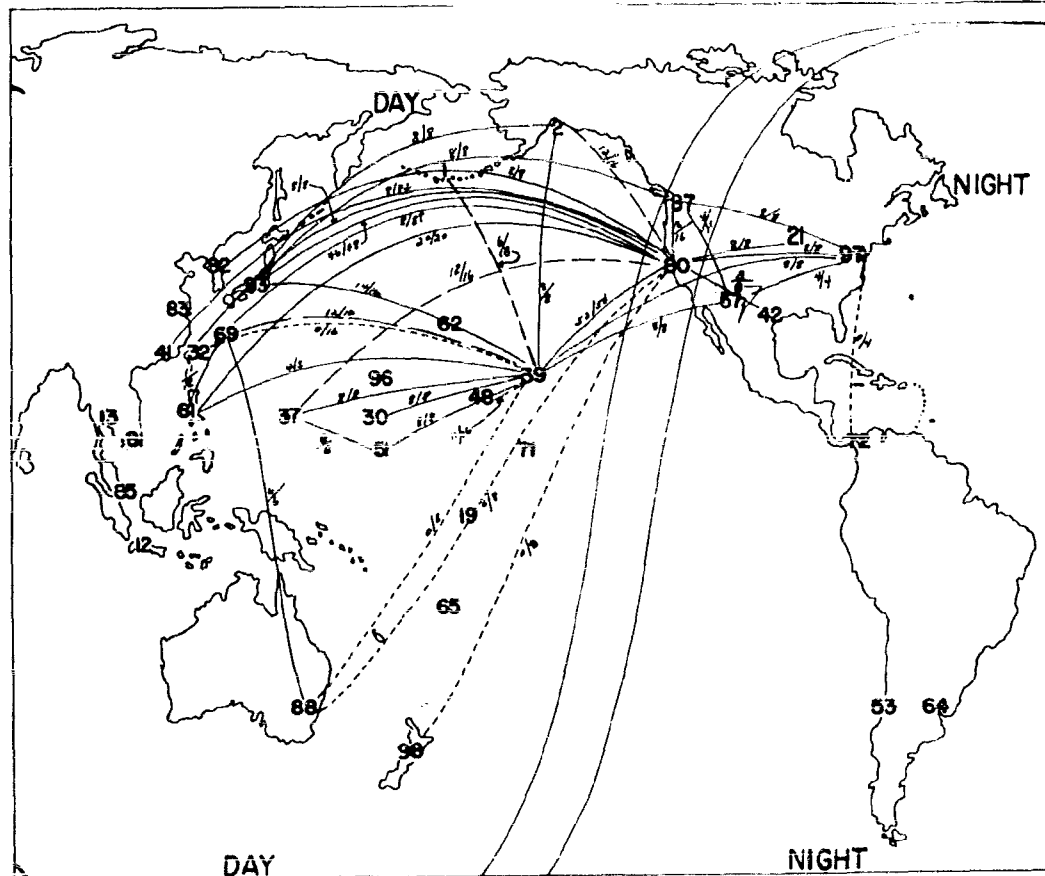
255

Figure 113b

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0300Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAK        | 21. CHICAGO    | 41. HONOLULU         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SAIGON         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTICORNE      | 80. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANTU, FIJI IS. | 82. SEOUL          |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

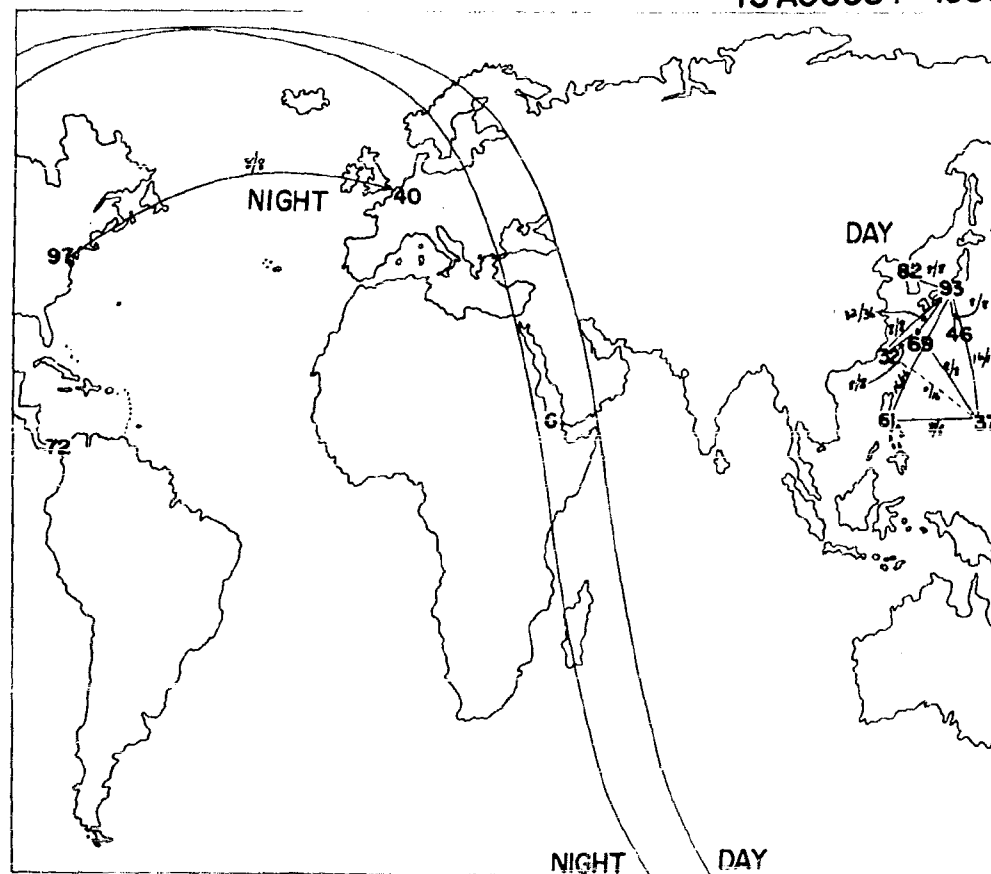
**SECRET**

Figure 114a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

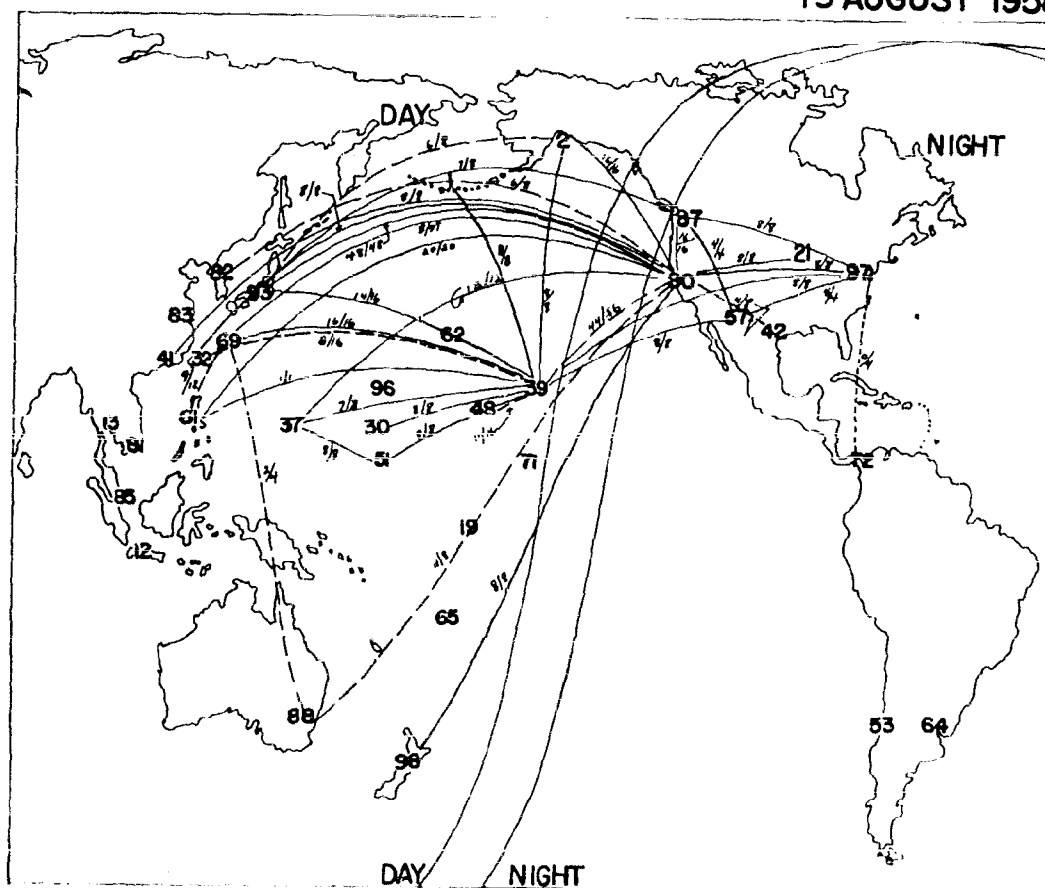
TIME INTERVAL CENTERED ON: 0300Z

13 AUGUST 1958



**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**  
**TIME INTERVAL CENTERED ON: 0400Z**

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

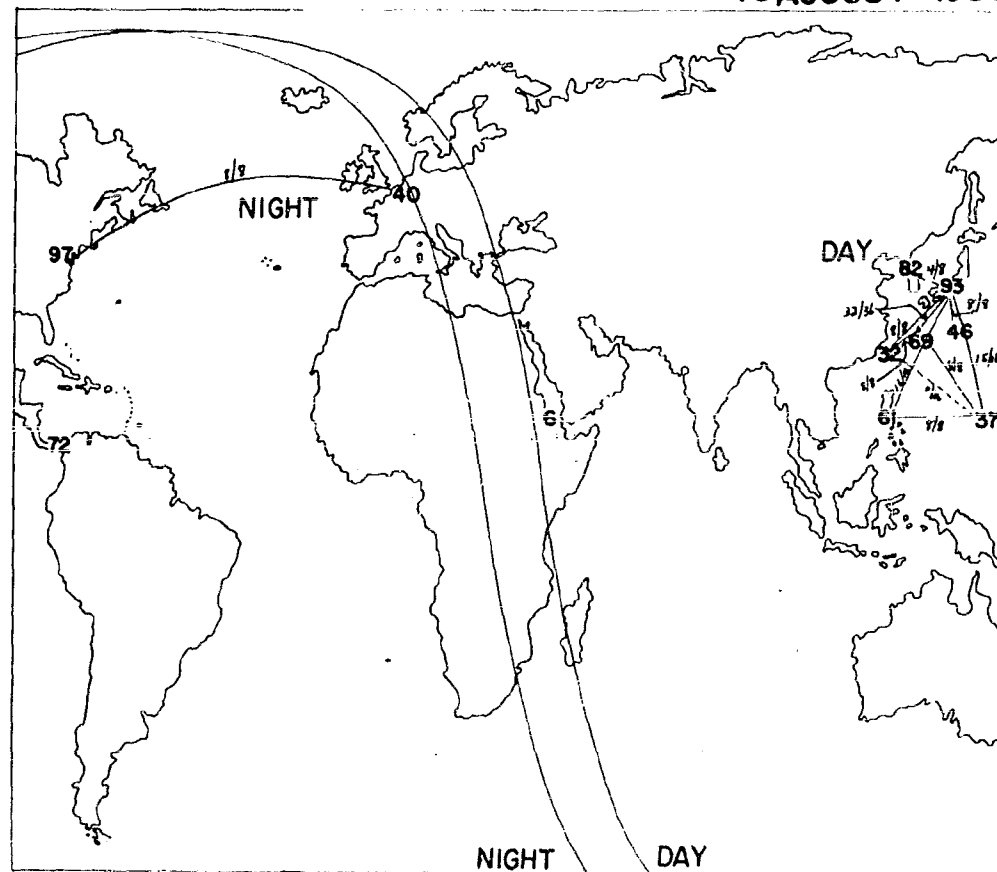
1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENTHWISTON	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. AEMARA	42. FUMMERA	46. TWO JIMA	62. MIKWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTIGRANDE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEGUL
19. CANTON IS.	40. HEIDELBERG	53. LA ORANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0400Z

13 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

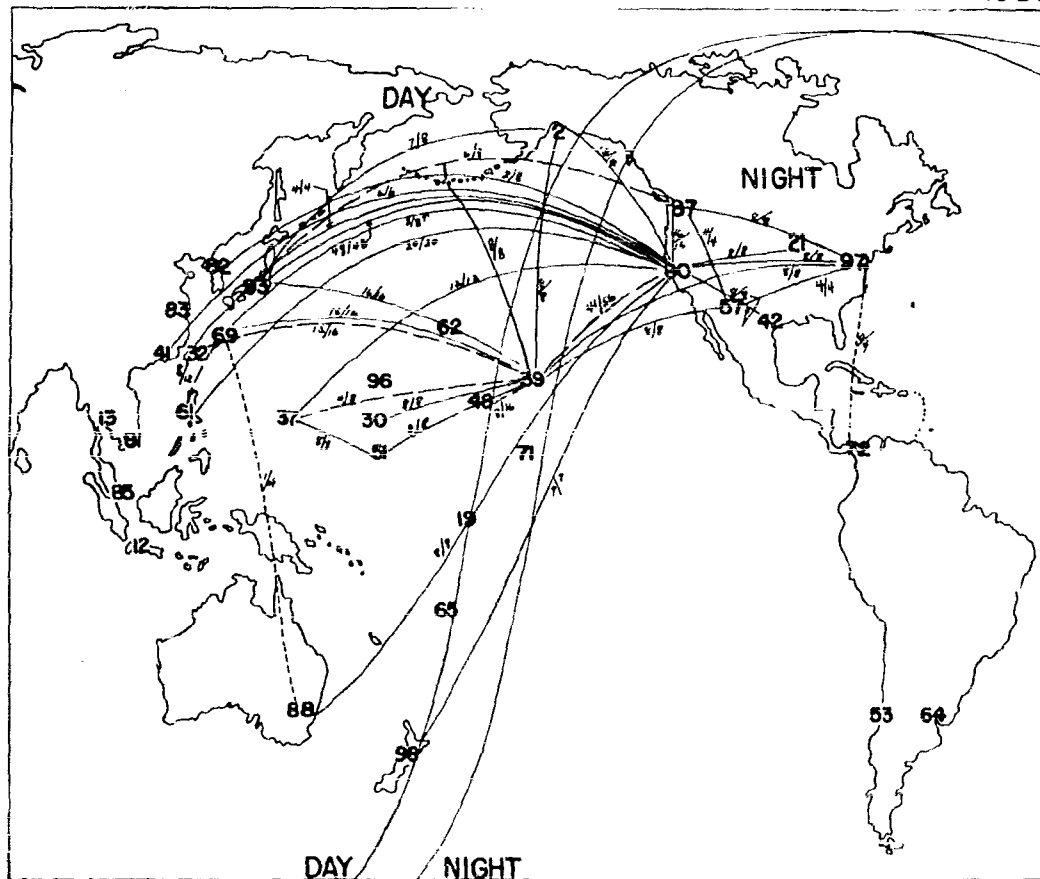
- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: —————
- ( $\frac{x}{y}$ ) - Numerator of fraction is  $4 \times$  (number of usable frequency hours.)  
 Denominator is  $4 \times$  (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0500Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

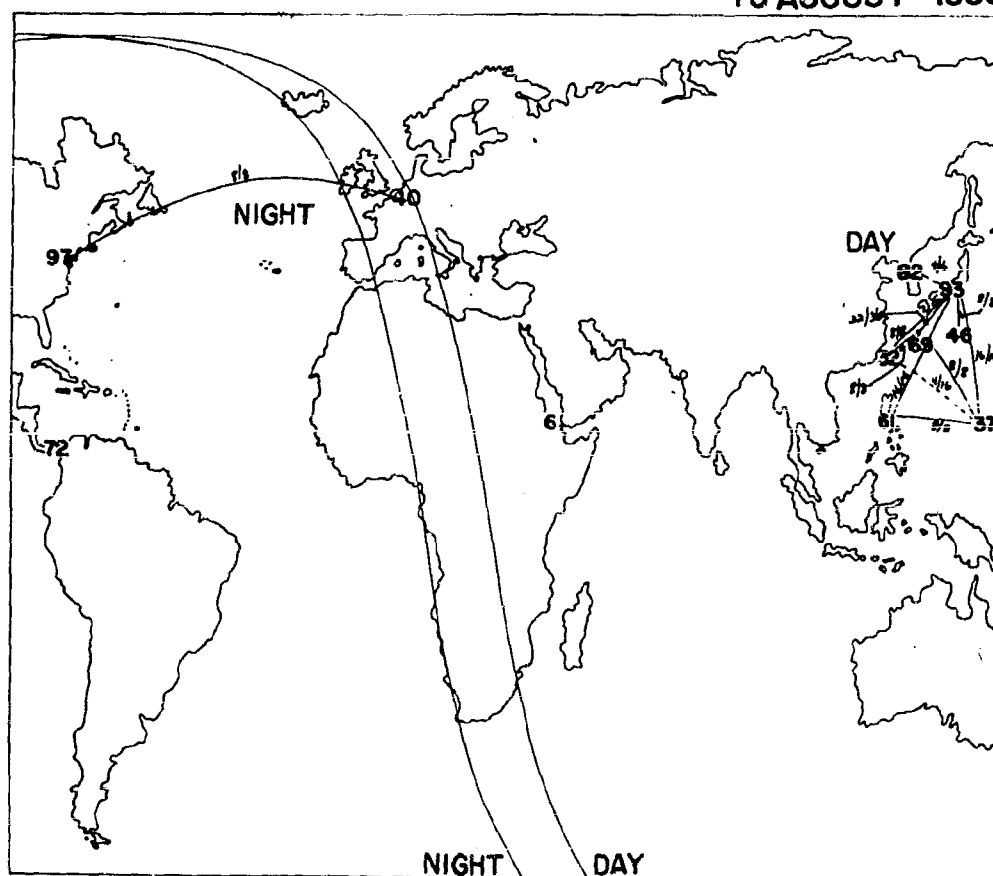
1. ADAM	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HUNTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICRANIE	80. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	83. SHANGHAI

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0500Z

13 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: —————

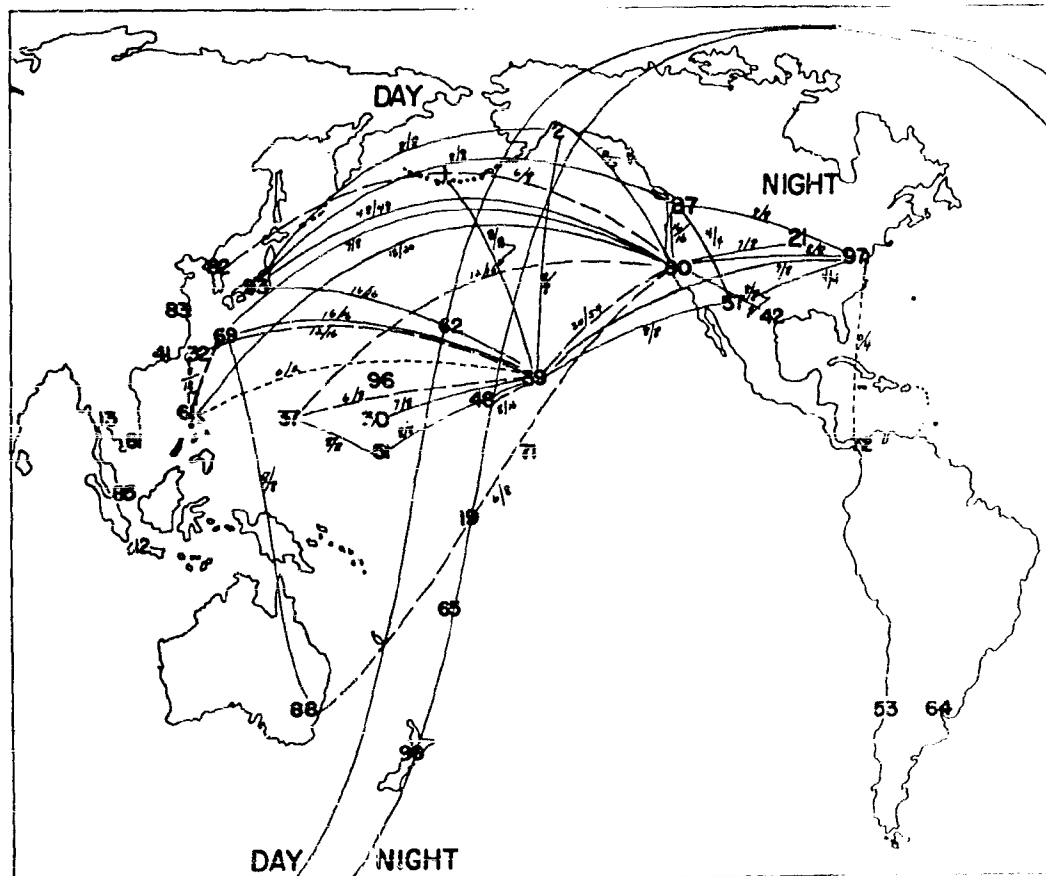
( $\frac{\quad}{\quad}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0600Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

- |                |                |                      |                     |                    |
|----------------|----------------|----------------------|---------------------|--------------------|
| 1. ADAK        | 21. CHICAGO    | 41. HONOLULU         | 57. LOS ALAMOS      | 71. PALMYRA IS.    |
| 2. ANCHORAGE   | 30. ENIWETOK   | 42. HOUSTON, FT. SAM | 61. MANILA          | 72. QUARRY HEIGHTS |
| 6. ASMARA      | 32. FORMOSA    | 46. IWO JIMA         | 62. MIDWAY          | 81. SATEEN         |
| 12. BANDUNG    | 37. GUAM       | 48. JOHNSTON IS.     | 64. MONTICORNE      | 82. SAN FRANCISCO  |
| 13. BANGKOK    | 39. HAWAII     | 51. KWAJALEIN        | 65. NANTY, FIJI IS. | 82. SEAB           |
| 19. CANTON IS. | 40. HEIDELBERG | 53. LA GRANJA        | 69. OKINAWA         | 83. SHANGHAI       |

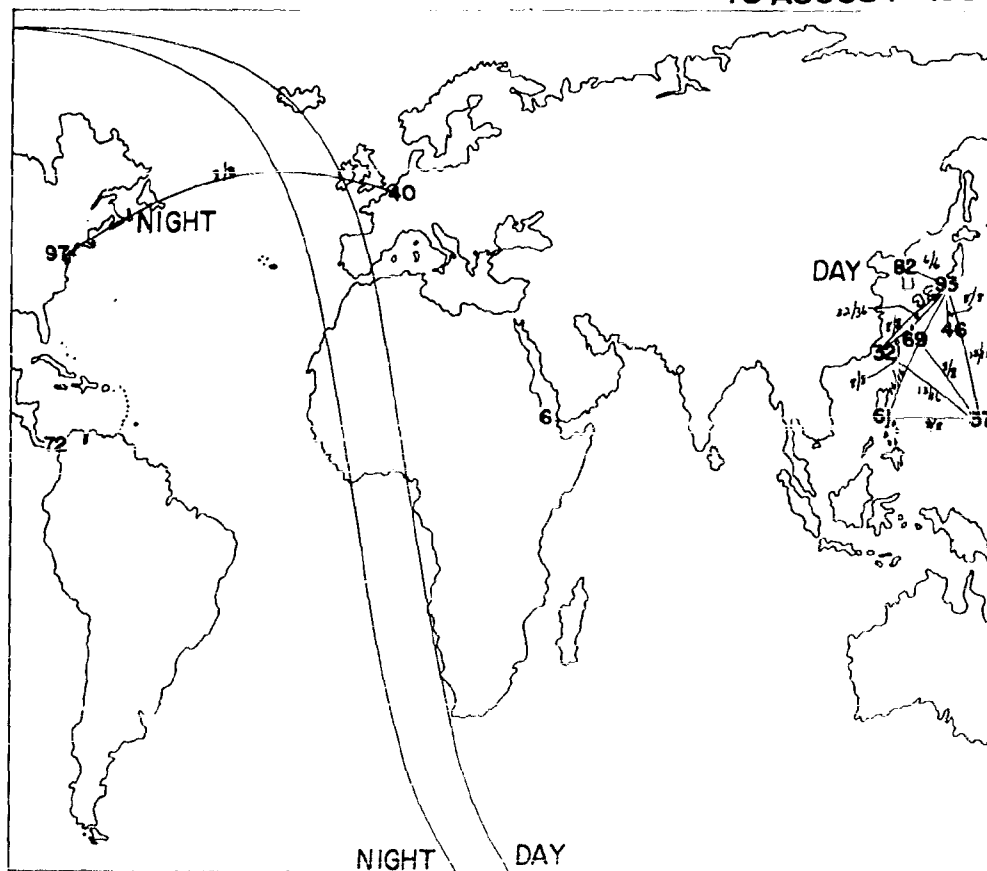
**SECRET**

Figure 117a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0600Z

13 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

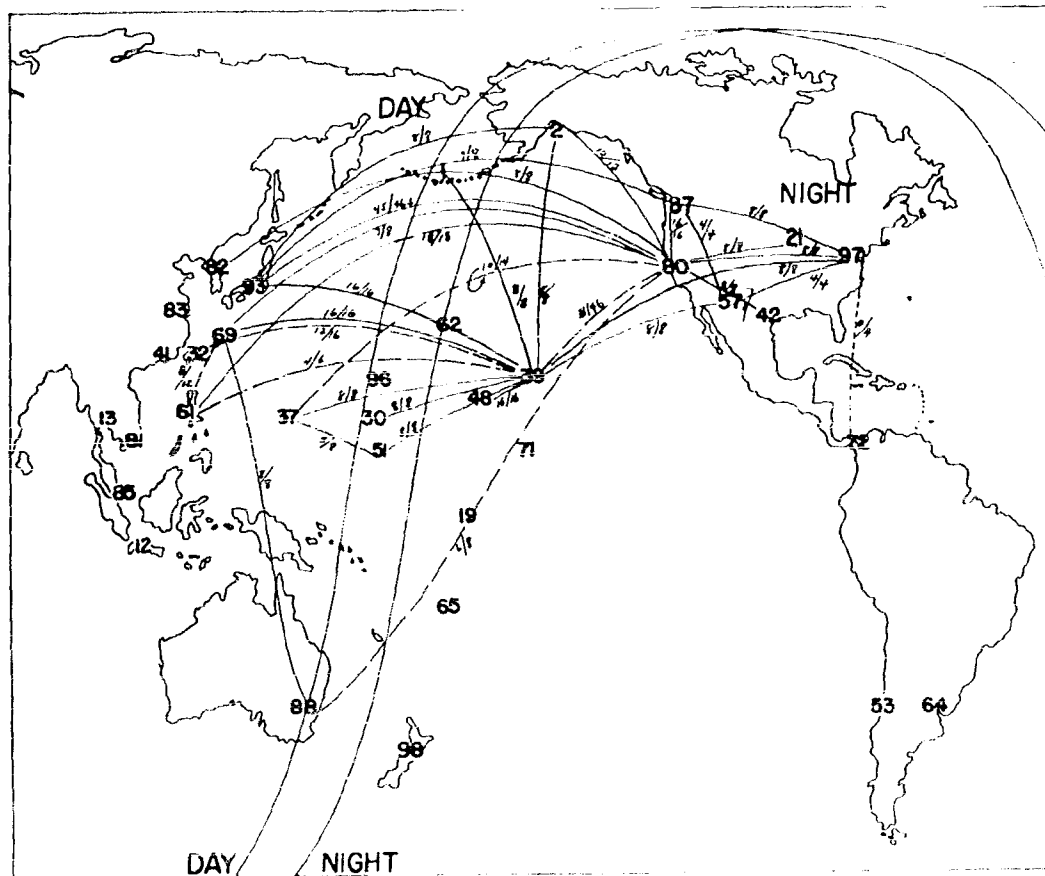
- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: — — — — —
- 80% to 100% of frequencies tried were useful: ——— ———
- ( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0700Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS:

1. ADAK	21. CHICAGO	41. HONGKONG	57. LAGUAYRA	71. PADMARA IS.
2. ANCHORAGE	30. ENIWETOK	42. HONOLULU, HI.	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SINGAPORE
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	86. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	87. SEOUL
19. CANTON IS.	40. KIELCEBERG	54. LA GUANJA	66. OKINAWA	88. SHANGHAI

**SECRET**  
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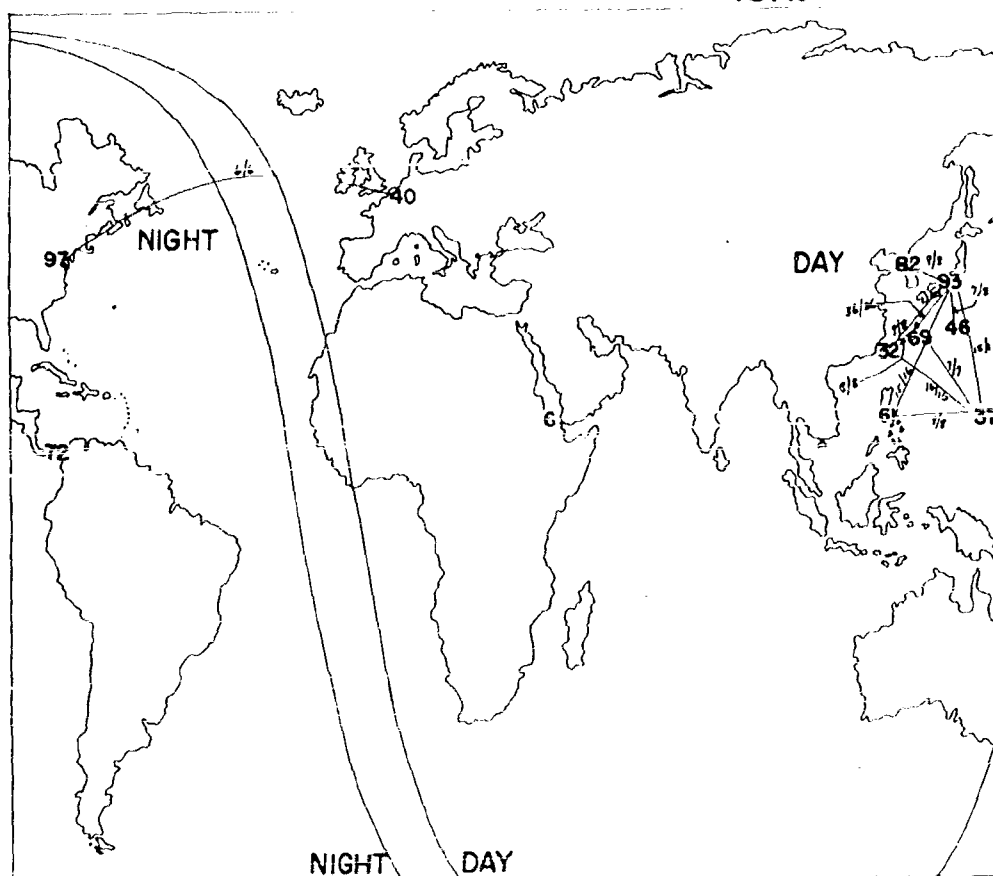
Figure 118a

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 0700Z

13 AUGUST 1958



KEY TO TERMINAL LOCATION:

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

KEY TO FREQUENCY UTILITY

- 0% to 30% of frequencies tried were useful: ————
- 30% to 60% of frequencies tried were useful: ————
- 60% to 100% of frequencies tried were useful: ————
- ( $\frac{x}{y}$ ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

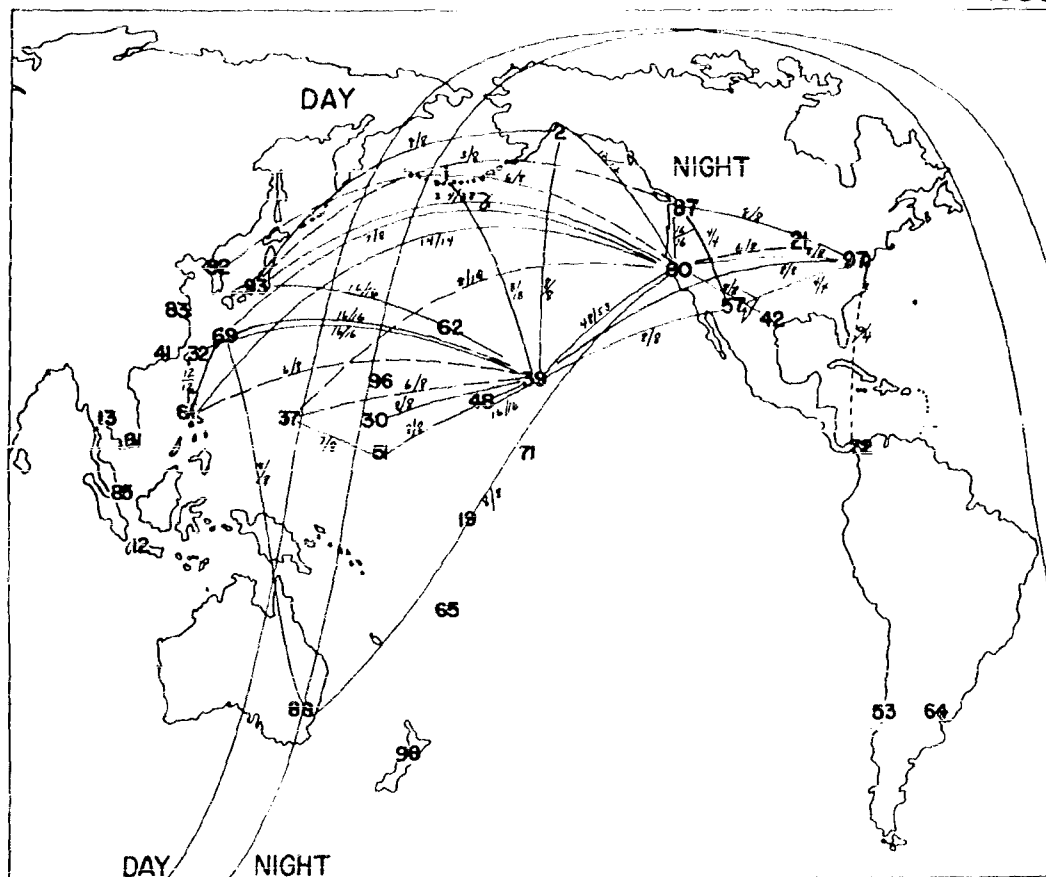
SECRET

SECRET

SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE  
DURING TIME INTERVAL OF ONE HOUR ALONG  
SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 0800Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

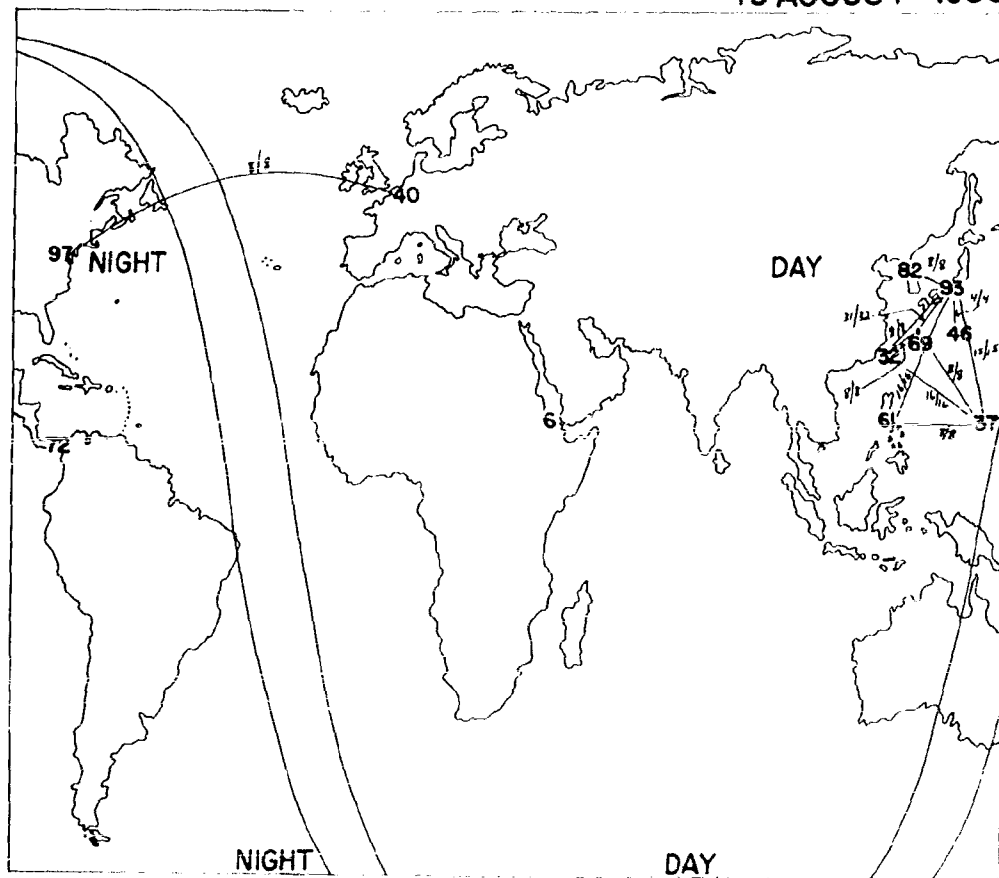
1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	86. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	67. NANDI, FIJI IS.	82. SEOUL
19. CANTON IS.	40. HEIMELBERG	53. LA ORANJA	69. OKINAWA	83. SHANGHAI

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0800Z

13 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

- 0% to 30% of frequencies tried were useful: ————
- 30% to 80% of frequencies tried were useful: ————
- 80% to 100% of frequencies tried were useful: ————
- ( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours.)
- Denominator is 4 x (number of frequency hours attempted during hour interval depicted.)

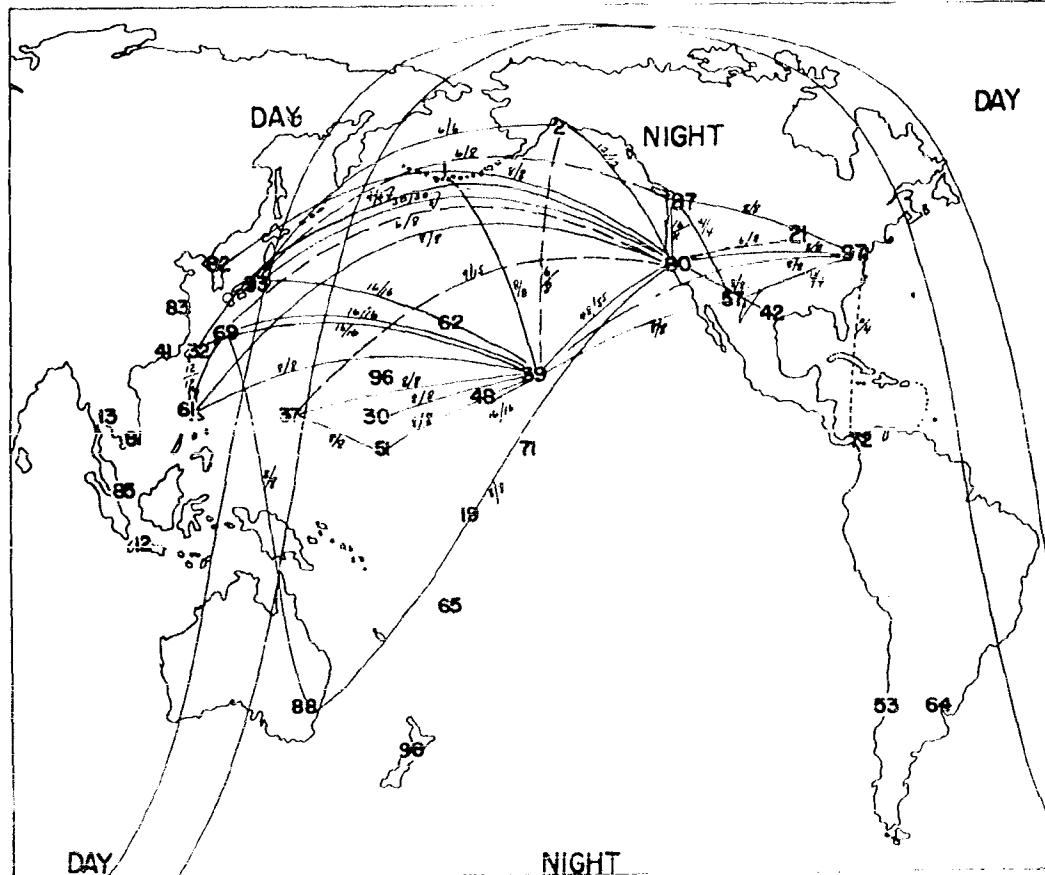
**SECRET**

# SECRET

## SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE DURING TIME INTERVAL OF ONE HOUR ALONG SELECTED GLOBAL COMMUNICATION PATHS

TIME INTERVAL CENTERED ON: 0900Z

13 AUGUST 1958



### KEY TO TERMINAL LOCATIONS

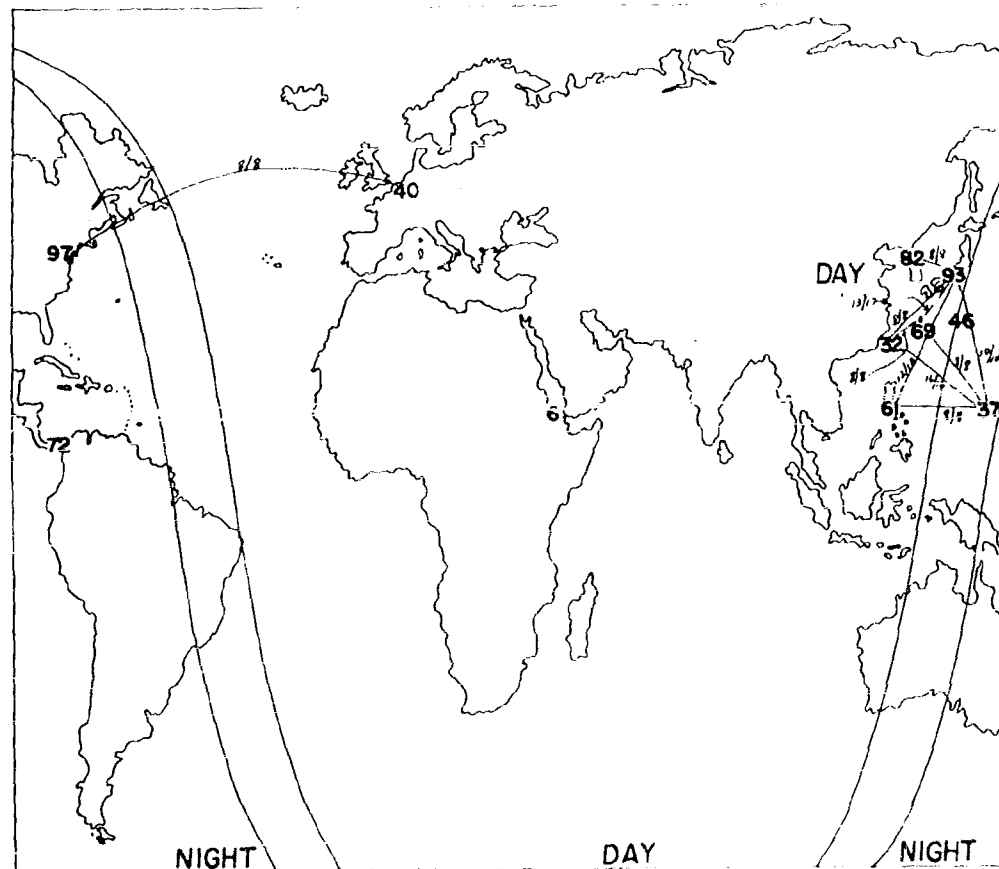
1. ADAX	21. CHICAGO	41. HONGKONG	57. LAS ALAMAS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FREMONT	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICLOMBO	82. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NANTU, FIJI IS.	83. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	88. SHANGHAI

SECRET

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 0900Z

13 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

- |               |                      |
|---------------|----------------------|
| 85. SINGAPORE | 96. WAKE IS.         |
| 87. SEATTLE   | 97. WASHINGTON, D.C. |
| 88. SYDNEY    | 98. WELLINGTON       |
| 93. TOKYO     |                      |

**KEY TO FREQUENCY UTILITY**

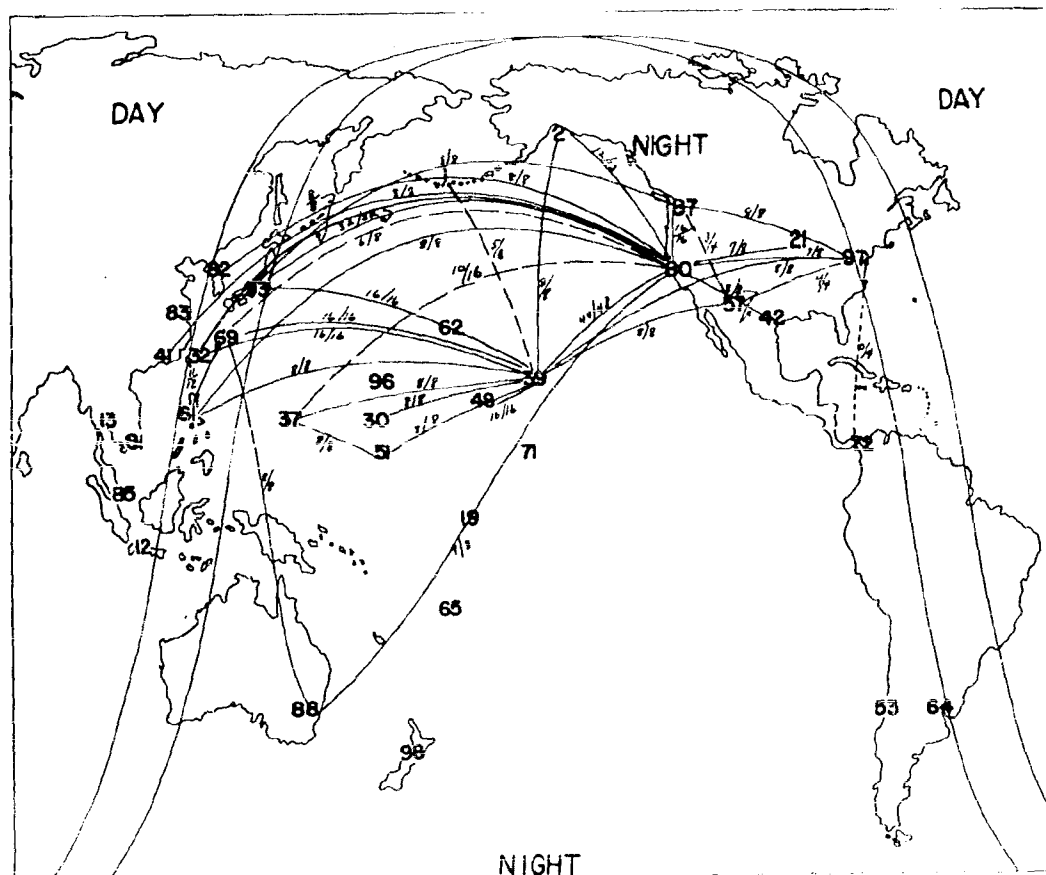
- 0% to 30% of frequencies tried were useful: - - - - -
- 30% to 80% of frequencies tried were useful: - - - - -
- 80% to 100% of frequencies tried were useful: - - - - -
- (X) = Numerator of fraction is 4 x (number of usable frequency hours)  
 Denominator is 4 x (number of frequency hours attempted  
 during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1000Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAX	21. CHICAGO	41. HONGKONG	57. LOS ANGELES	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, PT. SAM	61. MANILA	72. QUARRY HEIGHTS
6. ASMARA	32. FORMOSA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANDUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICRANIE	83. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWADJALEIN	65. NANOI, FIJI IS.	87. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	88. SHANGHAI

**SECRET**

TIME INTERVAL CENTERED ON: 1000Z

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	

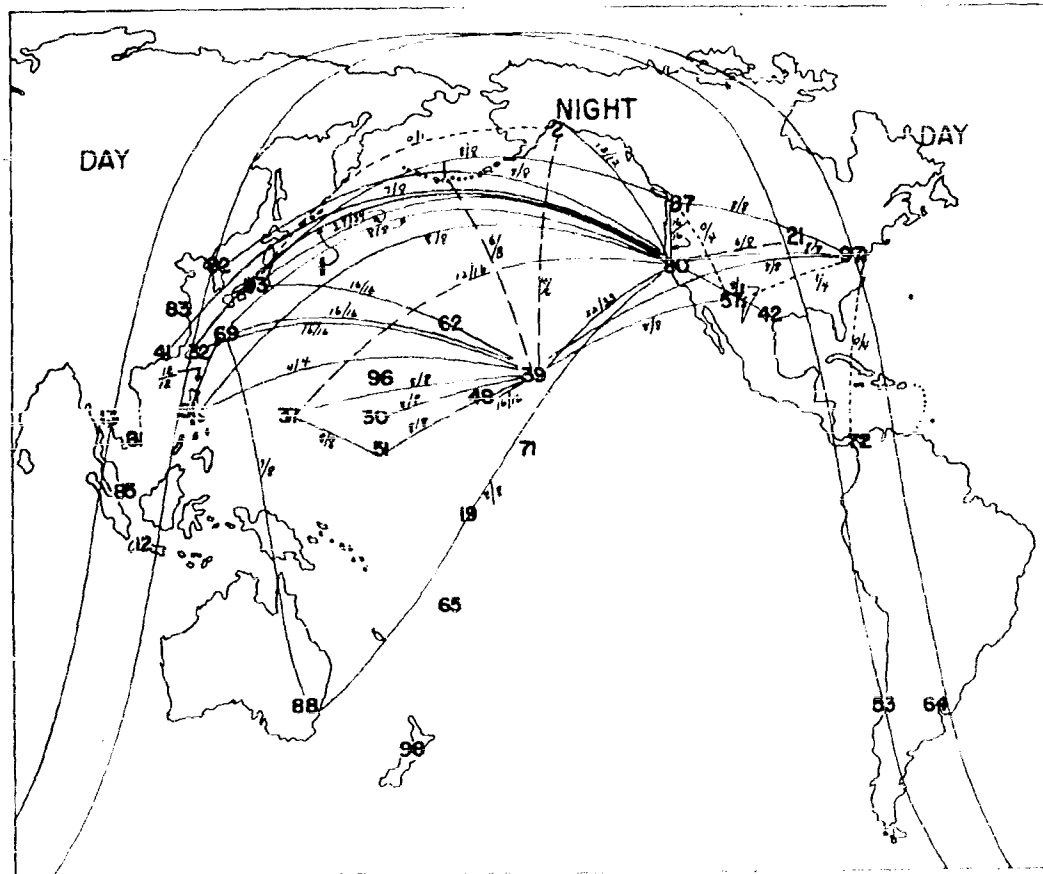
( ) / ( ) - Numerator of fraction is 4 x (number of usable frequency hours)  
Denominator is 4 x (number of frequency hours attempted  
during hour interval depicted.)

**SECRET**

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1100Z

13 AUGUST 1958



KEY TO TERMINAL LOCATIONS

1. ADAK	21. CHICAGO	41. HONGKONG	57. LOS ALAMOS	71. PALMYRA IS.
2. ANCHORAGE	30. ENIWETOK	42. HOUSTON, FT. SAM	61. MANILA	72. QUARRY HEIGHTS
5. AEMARA	32. FUJIMURA	46. IWO JIMA	62. MIDWAY	81. SAIGON
12. BANLUNG	37. GUAM	48. JOHNSTON IS.	64. MONTICORNE	82. SAN FRANCISCO
13. BANGKOK	39. HAWAII	51. KWAJALEIN	65. NAROI, FIJI IS.	83. SEOUL
19. CANTON IS.	40. HEIDELBERG	53. LA GRANJA	69. OKINAWA	84. SHANGHAI

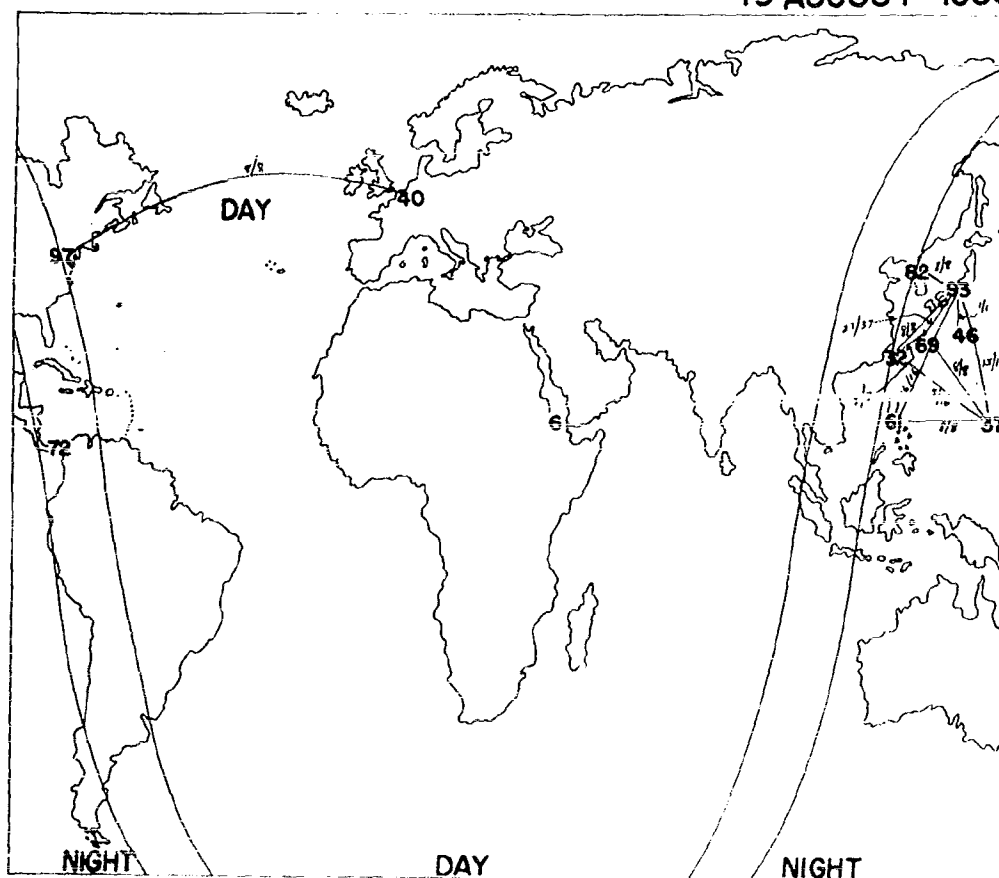
**SECRET**

Figure 122a

**SECRET**  
**SYNOPTIC MAP OF REPORTED CIRCUIT EXPERIENCE**  
**DURING TIME INTERVAL OF ONE HOUR ALONG**  
**SELECTED GLOBAL COMMUNICATION PATHS**

TIME INTERVAL CENTERED ON: 1100Z

13 AUGUST 1958



**KEY TO TERMINAL LOCATIONS**

85. SINGAPORE	96. WAKE IS.
87. SEATTLE	97. WASHINGTON, D.C.
88. SYDNEY	98. WELLINGTON
93. TOKYO	

**KEY TO FREQUENCY UTILITY**

0% to 30% of frequencies tried were useful: - - - - -  
 30% to 60% of frequencies tried were useful: - - - - -  
 60% to 100% of frequencies tried were useful: - - - - -

$\frac{(\quad)}{(\quad)}$  - Numerator of fraction is 4 x (number of usable frequency hours.)  
 Denominator is 4 x (number of frequency hours attempted during hour interval depicted)

**SECRET**

# SECRET

Table III

12 August 1958

Z time

Circuits between  
Honolulu and

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1030	1100	1130	1200	1230	1300
Los Alamos	8/ 8	8/ 8	8/ 8	6/ 8	5/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	4/ 8
Washington, D. C.	10/ 10	12/ 12	12/ 12	12/ 12	11/ 12	11/ 12	11/ 12	12/ 12	12/ 12	11/ 12	11/ 12	11/ 12	12/ 12	11/ 12	11/ 12	12/ 12	11/ 12
San Fran- cisco	28/ 28	36/ 36	32/ 35	36/ 36	35/ 36	32/ 35	33/ 33	39/ 40	59/ 64	62/ 64	45/ 46	42/ 43	44/ 47	44/ 48	50/ 56	53/ 67	52/ 61
Anchorage	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	6/ 8	8/ 8	6/ 8	8/ 8	8/ 8	8/ 8	6/ 8	6/ 8	7/ 8	6/ 8
Adak	10/ 10	16/ 16	10/ 16	12/ 16	14/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	14/ 16	12/ 16	14/ 16	16/ 16	16/ 16	16/ 16	12/ 16
Midway	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	6/ 8	8/ 8	6/ 8	8/ 8	8/ 8	8/ 10	5/ 12	0/ 12	0/ 12	0/ 12
Tokyo	16/ 30	20/ 38	20/ 51	14/ 43	23/ 35	32/ 45	39/ 49	40/ 48	40/ 46	48/ 48	41/ 47	41/ 50	41/ 52	42/ 51	43/ 52	44/ 48	44/ 53
Okinawa	12/ 12	16/ 16	16/ 16	16/ 16	16/ 16	12/ 16	16/ 16	16/ 16	16/ 16	16/ 16	12/ 16	11/ 16	10/ 16	8/ 16	8/ 16	11/ 16	12/ 16
Formosa	24/ 32	28/ 32	30/ 32	32/ 32	26/ 32	22/ 34	28/ 38	40/ 40	37/ 40	29/ 40	28/ 40	28/ 40	25/ 40	25/ 40	16/ 40	7/ 40	5/ 40
Manila	7/ 7	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	6/ 8	8/ 8	8/ 8	8/ 8	10/ 10	10/ 16	15/ 20	14/ 16	12/ 12	17/ 12	12/ 12
Wake											6/ 6	12/ 12	12/ 12	12/ 12	12/ 12	12/ 12	12/ 12
Guam	8/ 8	8/ 8	14/ 16	15/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	18/ 20	16/ 18	18/ 19	16/ 20	12/ 17	12/ 16	12/ 14	12/ 16
Eniwetok	8/ 8	8/ 8	6/ 6	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	7/ 8	7/ 8	8/ 9	6/ 8	5/ 8	8/ 8	8/ 8	8/ 8	8/ 8
Kwajalein	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	19/ 19	20/ 20	24/ 24	24/ 24	22/ 24	24/ 25	24/ 24	24/ 24	24/ 24
Johnston Is.	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	13/ 16	12/ 12	8/ 12	0/ 6	0/ 4	2/ 6	3/ 12	2/ 18	1/ 17	0/ 16	0/ 16	0/ 16
Sidney																	
Canton Is.																	
Nandi, Fiji Is.																	

Communication Capability for the day of and part of the day after the Orange nuclear shot of Circuit Paths which have one terminal in Honolulu.

Numerator is in units of quarter-hours of successful circuit communications over a period of one hour.

Denominator is in units of circuit quarter-hours of transmitter radiations over a period of one hour.

Z time is given for center of hourly period.

# SECRET

17 August 1958

Table III Continued  
Circuits between  
Honolulu and

Z time

	1330	1400	1430	1500	1530	1600	1630	1700	1730	1800	1830	1900	1930	2000	2030	2100	2130
Los Alamos	2/ 8	5/ 8	6/ 8	3/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	0/ 8	6/ 8	8/ 8
Washington, D. C.	6/ 12	5/ 11	4/ 9	2/ 8	0/ 8	0/ 8	2/ 9	4/ 5	4/ 8	4/ 8	4/ 8	4/ 8	4/ 8	6/ 8	8/ 8	8/ 8	8/ 8
San Fran- cisco	51/ 64	49/ 50	47/ 52	44/ 48	48/ 64	38/ 43	28/ 50	33/ 60	44/ 66	44/ 71	38/ 82	35/ 79	40/ 78	44/ 78	52/ 86	52/ 88	58/ 88
Anchorage	6/ 8	8/ 8	8/ 8	6/ 8	7/ 8	8/ 8	5/ 10	3/ 9	5/ 9	4/ 13	6/ 16	8/ 16	8/ 16	8/ 16	8/ 16	8/ 16	8/ 16
Adak	9/ 16	12/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16	16/ 16
Midway	0/ 12	2/ 12	1/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12	0/ 12
Tokyo	44/ 48	33/ 42	47/ 55	48/ 52	51/ 56	50/ 58	36/ 59	32/ 69	27/ 83	16/ 77	8/ 84	2/ 75	0/ 83	0/ 71	6/ 72	11/ 71	12/ 68
Okinawa	13/ 16	15/ 16	16/ 16	15/ 16	15/ 16	13/ 16	13/ 15	14/ 16	11/ 16	7/ 16	6/ 16	4/ 16	4/ 16	5/ 16	4/ 16	2/ 16	5/ 16
Formosa	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 40	0/ 32	0/ 24	0/ 24	0/ 24
Manila	12/ 12	12/ 12	10/ 12	12/ 12	12/ 12	10/ 12	12/ 13	11/ 12	12/ 14	12/ 15	14/ 22	10/ 28	9/ 28	12/ 27	10/ 24	10/ 27	10/ 28
Wake	12/ 12	12/ 12	12/ 12	12/ 12	12/ 12	6/ 6		2/ 2	4/ 4	2/ 2	0/ 2	2/ 4	4/ 4	2/ 8	1/ 12	3/ 12	7/ 12
Guam	15/ 16	11/ 16	16/ 16	16/ 16	16/ 16	16/ 16	17/ 19	16/ 20	14/ 17	12/ 16	8/ 17	8/ 16	4/ 16	0/ 14	2/ 17	9/ 17	9/ 17
Eniwetok	8/ 8	8/ 8	8/ 8	8/ 8	8/ 8	7/ 8	5/ 8	5/ 9	3/ 9	0/ 9	0/ 11	0/ 9	0/ 11	0/ 9	0/ 8	0/ 8	3/ 9
Kwajalein	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	24/ 24	22/ 24	16/ 19	8/ 12	2/ 8	2/ 8	2/ 8	1/ 10	5/ 12
Johnston Is.	0/ 16	3/ 16	8/ 16	10/ 16	7/ 16	8/ 16	8/ 16	5/ 16	4/ 16	1/ 16	0/ 16	0/ 16	0/ 16	0/ 16	0/ 16	0/ 16	0/ 16
Sidney										0/ 12	0/ 24	0/ 24	0/ 24	0/ 24	0/ 24	0/ 24	0/ 24
Canton Is.										6/ 8	14/ 16	13/ 16	11/ 16	7/ 16	4/ 16	0/ 16	0/ 16
Nandi, Fiji Is.							0/ 6	0/ 12	0/ 12	0/ 16	0/ 20	0/ 20	0/ 20	0/ 20	0/ 20	0/ 20	0/ 20

# SECRET

Table III Continued 12 August 1958  
Circuits between  
Honolulu and

13 August 1958

	2200	2230	2300	2330	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
Los Alamos	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8
Washington, D. C.	8/8	7/8	8/10	12/12	8/8	6/8	8/8	8/8	8/8	8/8	7/8	8/8	8/8	8/8	8/8	8/8	8/8
San Francisco	56/88	60/88	68/88	76/86	62/64	52/56	40/54	52/56	44/56	41/56	30/54	31/46	48/53	48/55	44/48	32/33	
Anchorage	8/12	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	6/8	8/8	4/6	
Adak	16/16	16/16	16/16	16/16	10/12	1/8	4/8	6/8	8/8	8/8	8/8	8/8	8/8	8/8	5/8	6/8	
Midway	1/12	2/12	1/12	0/12	0/8												
Tokyo	11/68	11/68	10/64	12/64	15/41	16/16	16/16	14/16	14/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16
Okinawa	5/16	1/16	4/16	2/16	4/16	12/16	10/16	12/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16
Formosa	0/24	0/24	0/24	0/24	0/20	0/16	0/16	0/16	3/16	12/16	12/16	12/16	16/16	16/16	16/16	16/16	16/16
Manila	16/28	16/30	16/30	16/28	15/14	8/8	8/8	4/5	1/1		2/2	4/6	6/8	8/8	8/8	1/5	
Wake	12/12	8/12	3/12	0/8	0/2												
Guam	12/16	11/16	4/14	4/14	4/10	8/8	8/8	8/8	7/8	4/8	6/8	8/8	6/8	8/8	8/8	8/8	8/8
Eniwetok	5/9	4/10	2/11	0/8	2/8	4/8	8/8	8/8	8/8	8/8	7/8	8/8	8/8	8/8	8/8	8/8	8/8
Kwajalein	8/16	6/12	3/10	1/8	0/8	1/8	4/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8	8/8
Johnston Is.	0/16	0/16	0/16	0/16	0/16	6/16	12/16	11/16	11/16	8/16	8/16	16/16	16/16	16/16	16/16	16/16	16/16
Sidney	0/24	0/24	0/24	0/24	0/24	0/12	0/12	0/3									
Canton Is.	0/16	0/16	0/16	0/16	0/16												
Nandi, Fiji Is.	0/20	0/20	0/20	0/20	0/20												

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Table IV

12 August 1958

Circuits between  
San Francisco and

Z time

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1030	1100	1130	1200	1230	1300
Ft. Sam Houston	8/ /8	5/ /8	4/ /8	8/ /8	7/ /8	8/ /8	4/ /8	5/ /8	8/ /8	7/ /8	7/ /8	6/ /8	4/ /8	4/ /8	4/ /8	4/ /8	4/ /8
Washington, D. C.	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	6/ /8	6/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	7/ /8	5/ /8	5/ /8	5/ /8
Chicago	8/ /8	8/ /8	8/ /8	6/ /8	8/ /8	8/ /8	6/ /8	8/ /8	8/ /8	6/ /8	4/ /8	4/ /8	4/ /8	4/ /8	4/ /8	4/ /8	4/ /8
Seattle	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	8/ /9	12/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16
Anchorage	10/ /10	16/ /16	16/ /16	15/ /16	12/ /16	14/ /14	16/ /18	18/ /20	17/ /20	17/ /21	19/ /20	19/ /20	16/ /20	18/ /20	20/ /20	20/ /20	20/ /20
Korea							2/ /4	8/ /9	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8
Hongkong										5/ /5	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8
Formosa										8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8
Tokyo	14/ /14	16/ /16	16/ /16	16/ /16	16/ /16	14/ /16	14/ /16	28/ /28	42/ /42	47/ /50	48/ /48	45/ /45	42/ /44	39/ /42	37/ /40	36/ /40	36/ /40
Okinawa							2/ /4	4/ /8	10/ /10	8/ /8	8/ /8	8/ /8	4/ /4				
Manila	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	12/ /12	20/ /20	23/ /23	16/ /19	18/ /19	20/ /20	20/ /20	20/ /20	20/ /20	20/ /20
Bandung															8/ /8	8/ /8	8/ /8
Guam							5/ /7	10/ /10	12/ /16	12/ /16	13/ /16	15/ /16	16/ /16	12/ /12	8/ /8	8/ /8	8/ /8
Shanghai																	
Sidney							4/ /4	8/ /8	8/ /8	6/ /8	6/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8
Singapore																	
Wellington																	

Communication Capability for the day of and part of the day after the Orange nuclear shot of Circuit Paths which have one terminal in San Francisco.

Numerator is in units of quarter-hours of successful circuit communications over a period of one hour.

Denominator is in units of circuit quarter-hours of transmitter radiations over a period of one hour.

Z time is given for center of hourly period.

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12 August 1958

Table IV Continued  
Circuits between  
San Francisco and

Z time

	1330	1400	1430	1500	1530	1600	1630	1700	1730	1800	1830	1900	1930	2000	2030	2100	2130
Ft Sam Houston	6/ /8	8/ /8	8/ /8	8/ /8	8/ /8	9/ /9	9/ /9	8/ /8	7/ /8	4/ /8	6/ /8	8/ /8	8/ /8	6/ /8	5/ /8	5/ /8	7/ /8
Washington, D. C.	8/ /8	8/ /8	9/ /10	8/ /10	8/ /9	8/ /8	8/ /8	8/ /8	8/ /8	6/ /8	7/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8
Chicago	5/ /8	7/ /8	8/ /8	7/ /8	5/ /8	4/ /8	4/ /8	4/ /8	4/ /8	4/ /8	7/ /8	8/ /8	8/ /8	8/ /8	6/ /8	2/ /8	0/ /8
Seattle	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16
Anchorage	20/ /20	17/ /20	15/ /20	15/ /20	15/ /16	16/ /16	16/ /16	14/ /16	12/ /16	12/ /16	13/ /16	13/ /16	16/ /16	15/ /15	16/ /16	20/ /20	20/ /20
Korea	8/ /8	6/ /8	4/ /8	6/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	6/ /6			2/ /4	6/ /8	6/ /8	8/ /8	8/ /8
Hongkong	8/ /8	4/ /4															
Formosa	8/ /8	4/ /4	2/ /2														
Tokyo	37/ /40	42/ /43	44/ /44	42/ /42	40/ /40	39/ /39	40/ /40	36/ /36	35/ /35	29/ /35	24/ /36	25/ /36	32/ /36	35/ /35	37/ /37	35/ /35	33/ /33
Chinawa																	
Manila	20/ /20	20/ /20	20/ /20	20/ /20	20/ /20	20/ /20	20/ /20	20/ /20	20/ /20	19/ /19	14/ /14	12/ /12	12/ /12	16/ /16	20/ /20	19/ /19	16/ /16
Bandung	8/ /8	8/ /8	7/ /7														
Guam	7/ /9	4/ /8	4/ /8	4/ /8	4/ /8	4/ /7	4/ /8	6/ /8	8/ /8	6/ /8	6/ /8	2/ /8	0/ /8	0/ /8	0/ /8	4/ /12	7/ /15
Shanghai																	
Sidney	6/ /8	6/ /8	6/ /8	3/ /6	1/ /2										0/ /4	0/ /8	0/ /8
Singapore	2/ /4	3/ /5	5/ /6	8/ /8	6/ /6	2/ /2											
Wellington				4/ /4	8/ /8	8/ /8	8/ /8	4/ /4									

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12 August 1958

13 August 1958

Table IV Continued  
Circuits between  
San Francisco and

	2200	2230	2300	2330	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200
Ft Sam	8/ /8	7/ /8	4/ /8	5/ /8	8/ /8	7/ /8	8/ /8	8/ /8	4/ /8	8/ /8	3/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8
Houston																	
Washington, D. C.	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	7/ /8	7/ /8	7/ /8
Chicago	4/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	7/ /8	8/ /8	6/ /8	6/ /8	7/ /8	6/ /8	6/ /8
Seattle	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16	16/ /16
Anchorage	20/ /20	20/ /20	19/ /19	17/ /17	14/ /14	12/ /12	9/ /9	12/ /12	16/ /16	13/ /13	10/ /10	10/ /10	12/ /12	12/ /12	12/ /12	12/ /12	12/ /12
Korea	8/ /8	8/ /8	8/ /8	7/ /8	4/ /8	4/ /8	8/ /8	8/ /8	6/ /8	8/ /8	6/ /8	8/ /8	6/ /8	8/ /8	8/ /8	8/ /8	8/ /8
Hongkong						4/ /8	8/ /8	8/ /8	8/ /8	6/ /6					8/ /8	7/ /8	7/ /8
Formosa			4/ /4	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	4/ /4				4/ /4	8/ /8	8/ /8	8/ /8
Tokyo	32/ /32	32/ /32	34/ /34	44/ /44	28/ /28	46/ /46	47/ /47	46/ /46	48/ /48	48/ /48	48/ /48	45/ /45	34/ /34	30/ /30	32/ /32	29/ /29	29/ /29
Osaka			4/ /4	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8	7/ /7	7/ /7	7/ /7	6/ /6	6/ /6	8/ /8	8/ /8
Manila	22/ /22	26/ /26	28/ /28	28/ /28	24/ /24	20/ /20	20/ /20	20/ /20	20/ /20	20/ /20	18/ /18	18/ /18	14/ /14	8/ /8	8/ /8	8/ /8	8/ /8
Bandung																	
Guam	8/ /16	8/ /16	7/ /16	5/ /16	9/ /16	16/ /16	12/ /12	12/ /12	12/ /12	12/ /12	12/ /12	10/ /10	8/ /16	9/ /15	10/ /16	12/ /16	12/ /16
Shanghai	4/ /4	8/ /8	4/ /4														
Sidney	0/ /8	0/ /8	0/ /8	0/ /8	0/ /8	0/ /8	0/ /8	0/ /8	4/ /8	8/ /8	6/ /8	6/ /8	8/ /8	8/ /8	8/ /8	8/ /8	8/ /8
Singapore																	
Wellington							0/ /4	0/ /8	8/ /8	7/ /7							

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## KEYS TO FREQUENCY UTILIZATION BAR CHARTS OF COMBINED CIRCUIT EXPERIENCE VS FREQUENCY LIMITATIONS

Circuit Experience:

KEY B

Circuit { Passed.....  
Failed\_\_\_\_\_


Bars are plotted only for periods of successful reception or for outages definitely attributed to propagation conditions. All other types of interruptions or a lack of reported data result in the omission of the bar. Length of the bar corresponds to the duration of circuit condition. Arrowheads on bars indicate direction of traffic flow; for example, arrows directed to the left signify reception by the first terminal mentioned on the chart heading.


Data Identification Code:

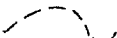
Receiving Agency	Type of Service	User's Designation
A = ACAN	1 = Single Side Band	(1) = Circuit #1
B = AT&T	2 = Speech	(2) = Circuit #2
C = US NAVY	3 = CS RTT	(3) = Circuit #3
D = CAA	4 = MUX 4-ch	(4) = Circuit #4
E = AACS	7 = 2ch RTT	
F = CIA (monitoring)	8 = Aggregate Signal	
G = RCA	Strength Recording	
H = Mackay Radio		
I = Globe Radio		
J = AVCO		

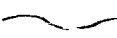
Example: B 2 (3) = AT&T Radiotelephone Circuit Number 3

Frequency Limitations:

 Predicted Monthly Median of (undisturbed) Daily Values

MUF  Observed  $F_2$  MUF from Vertical Incidence Data

 Observed  $E_s$  MUF from Vertical Incidence Data

LUF  Observed  $F_{min}$  from Vertical Incidence Data

Notes:

Predicted Monthly Median Values apply to 30 day period centered on test  
Observed Values apply to Date of chart  
Observed Values based on Vertical Incidence Data taken at the Maui Ionosphere Station located in the Hawaiian Islands communication Area

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## KEY TO FREQUENCY BAR CHARTS DEPICTING COMPARISON OF CIRCUIT EXPERIENCE, ENGINEERING FACTORS AND FREQUENCY LIMITATIONS

Circuit Experience:

KEY C

Circuit { Passed . . . . .  
Failed \_\_\_\_\_

Bars plotted only for periods of successful reception or of outages definitely attributed to propagation conditions. All other interruptions or a lack of reported data result in omission of the bar. Length of bar corresponds to duration of circuit condition. Arrowheads on bars indicate direction of the traffic flow.

Data Identification Code:

Receiving Agency

A = ACAN

E = AACS

Type of Service

1 = Single Side Band


3 = CS RTT


Xmtr Output			Engineering Factors			
Power in Kw	Xmtg Ant	Revg Ant	Xmtr Output	Power in Kw	Xmtg Ant	Revg Ant
a 4.0	B	C	g 18.0	A	A	
b 2.0	B	C	h 10.0	A	A	
c 2.0	B	A	i 2.4	A	A	
d 4.0	A	A	j 9.0	A	A	
e 18.0	A	C	k 1.6	A	A	
f 10.0	A	C	m 2.0	A	B	

All antennas are standard type Rhombics.

Example: IJF Ale = ACAN circuit, SSB service, 18.0 Kw xmtr output power, xmtg antenna, type A Rhombic, receiving antenna, type C Rombic

Frequency Limitations:

MUF  Predicted Monthly Median of (undisturbed) Daily Values  
Observed F<sub>2</sub> MUF from Vertical Incidence Data  
Observed F<sub>3</sub> MUF from Vertical Incidence Data

IUF  Predicted Monthly Median of (undisturbed) Daily Values  
Observed F-min from Vertical Incidence Data

Notes: Predicted Monthly Median Values apply to 30 day period centered on test.

Observed Values apply to data of chart.

Observed values based on Vertical Incidence data taken at Maui Ionosphere Station located in the Hawaiian Islands communication area.

Predicted and Observed MUF limitations apply to all circuit bars.

Predicted IUF limitations apply to circuit bars using identical Identification Code.

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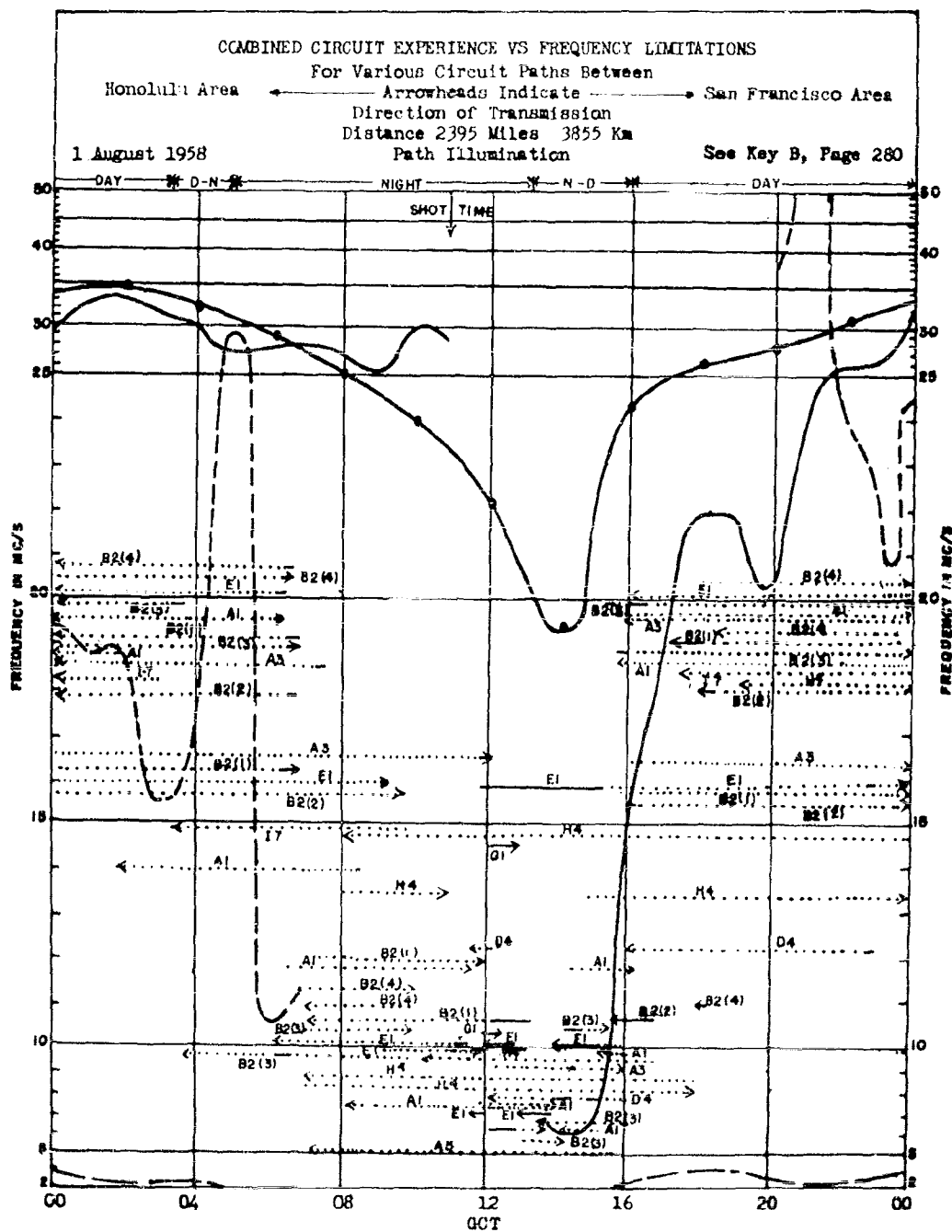
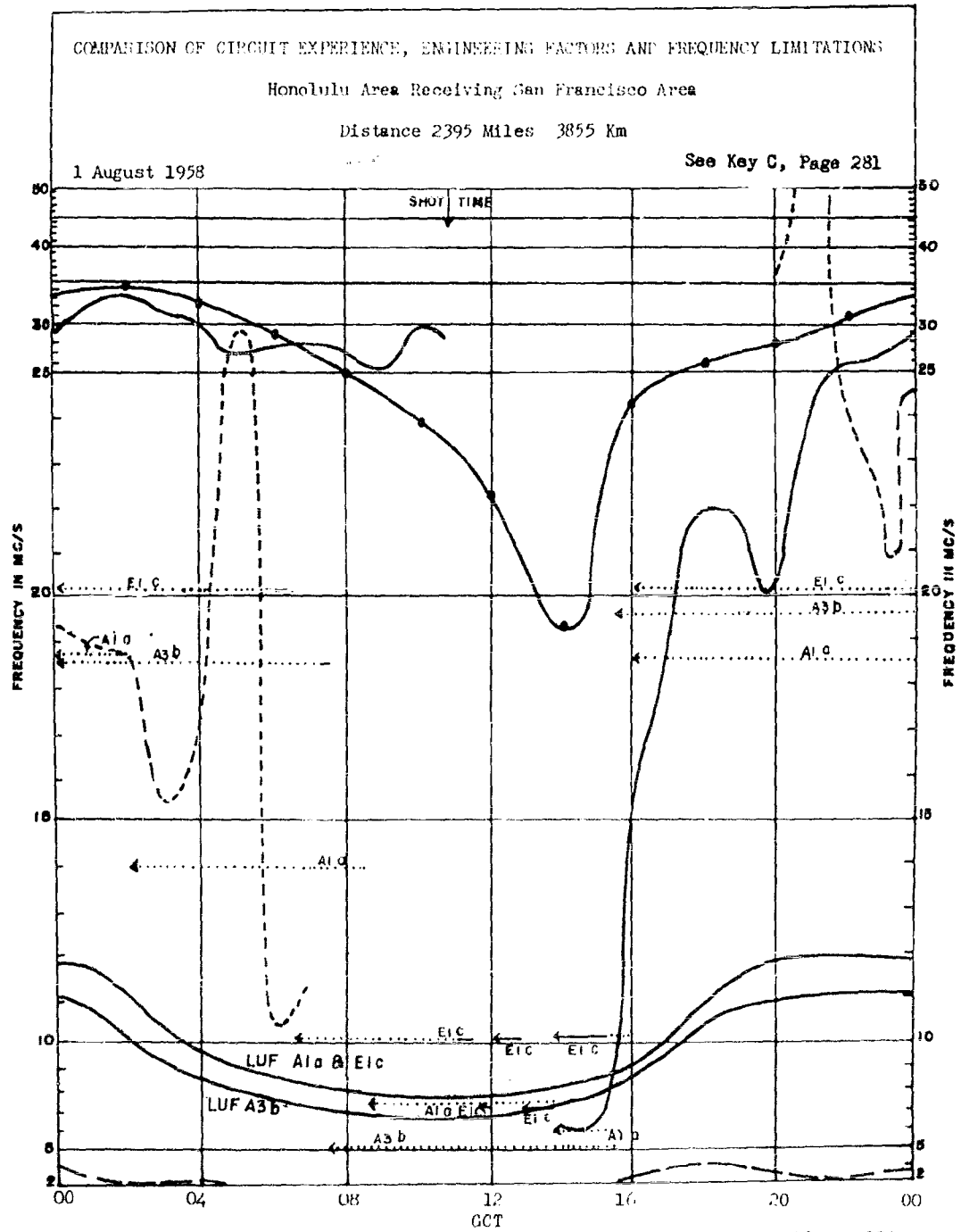


Figure 123

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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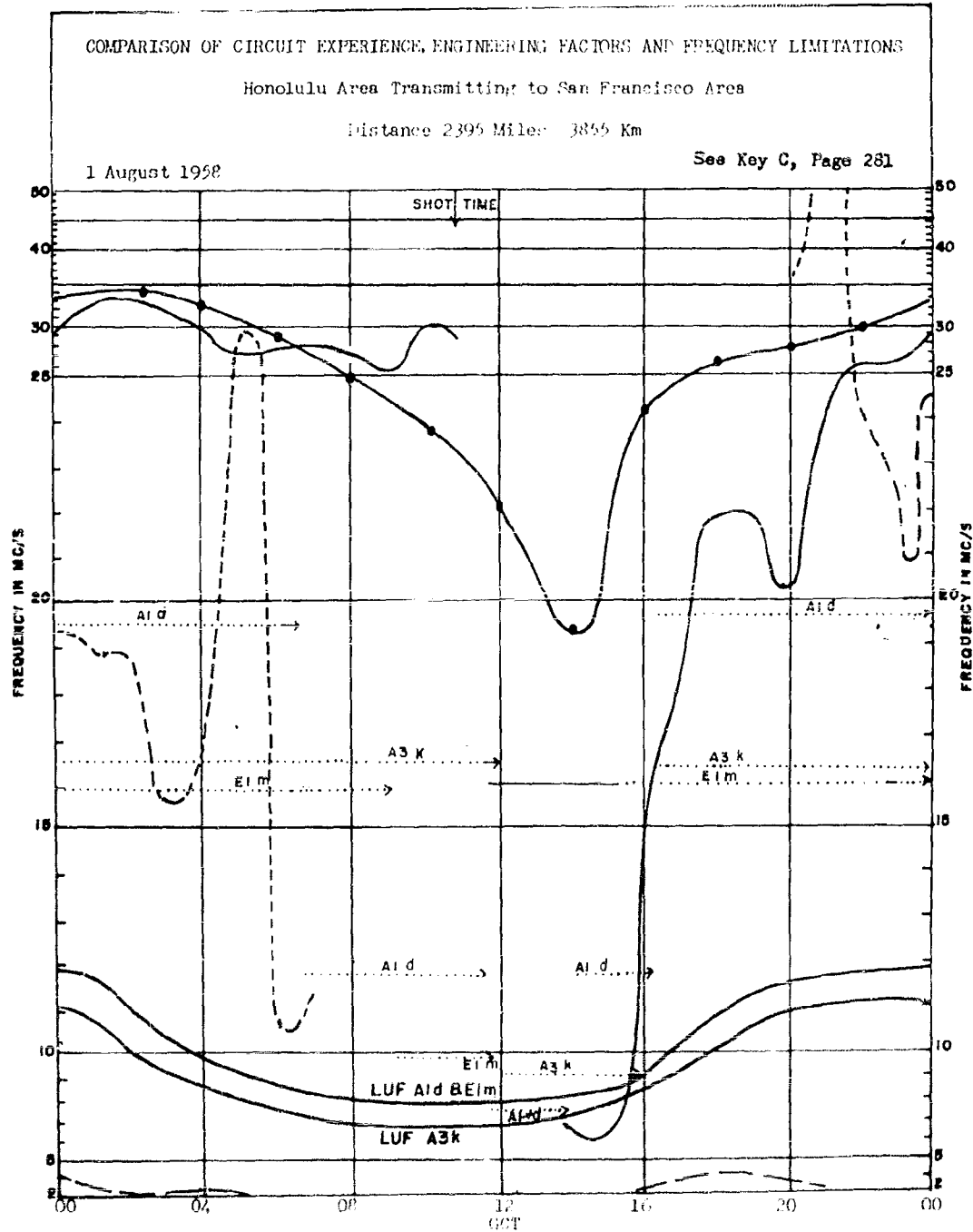


Figure 125

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

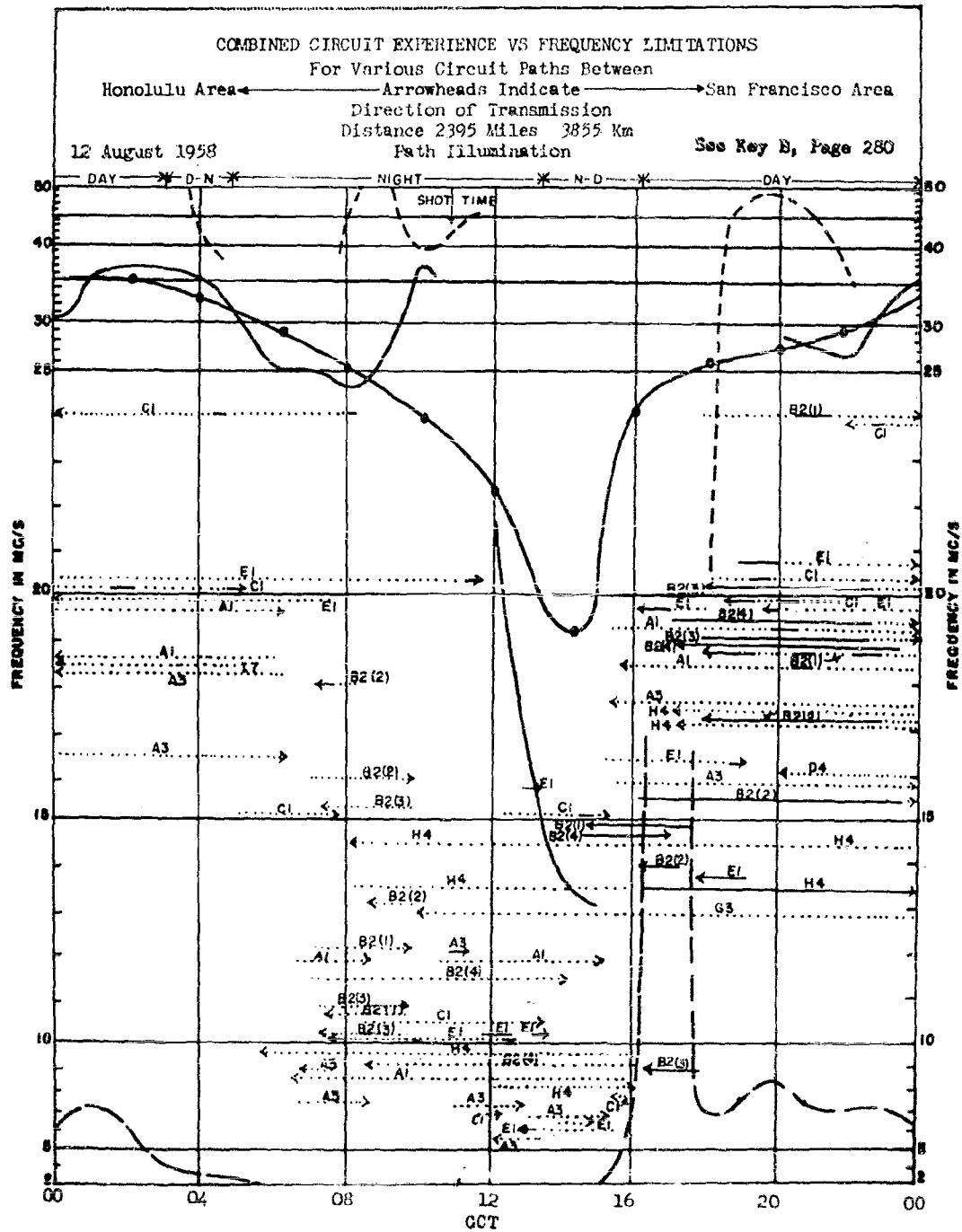


Figure 126

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U. S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY

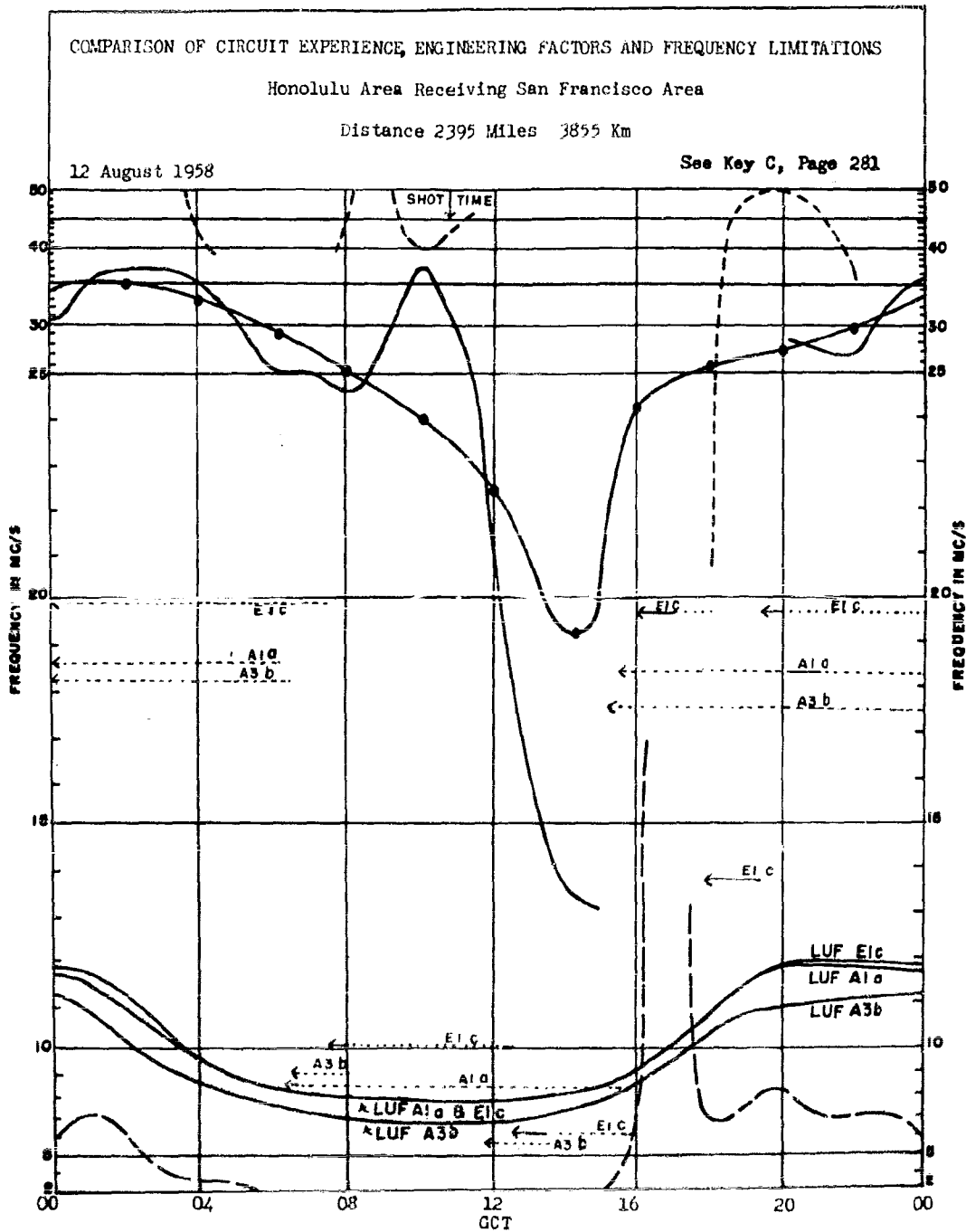


Figure 127

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

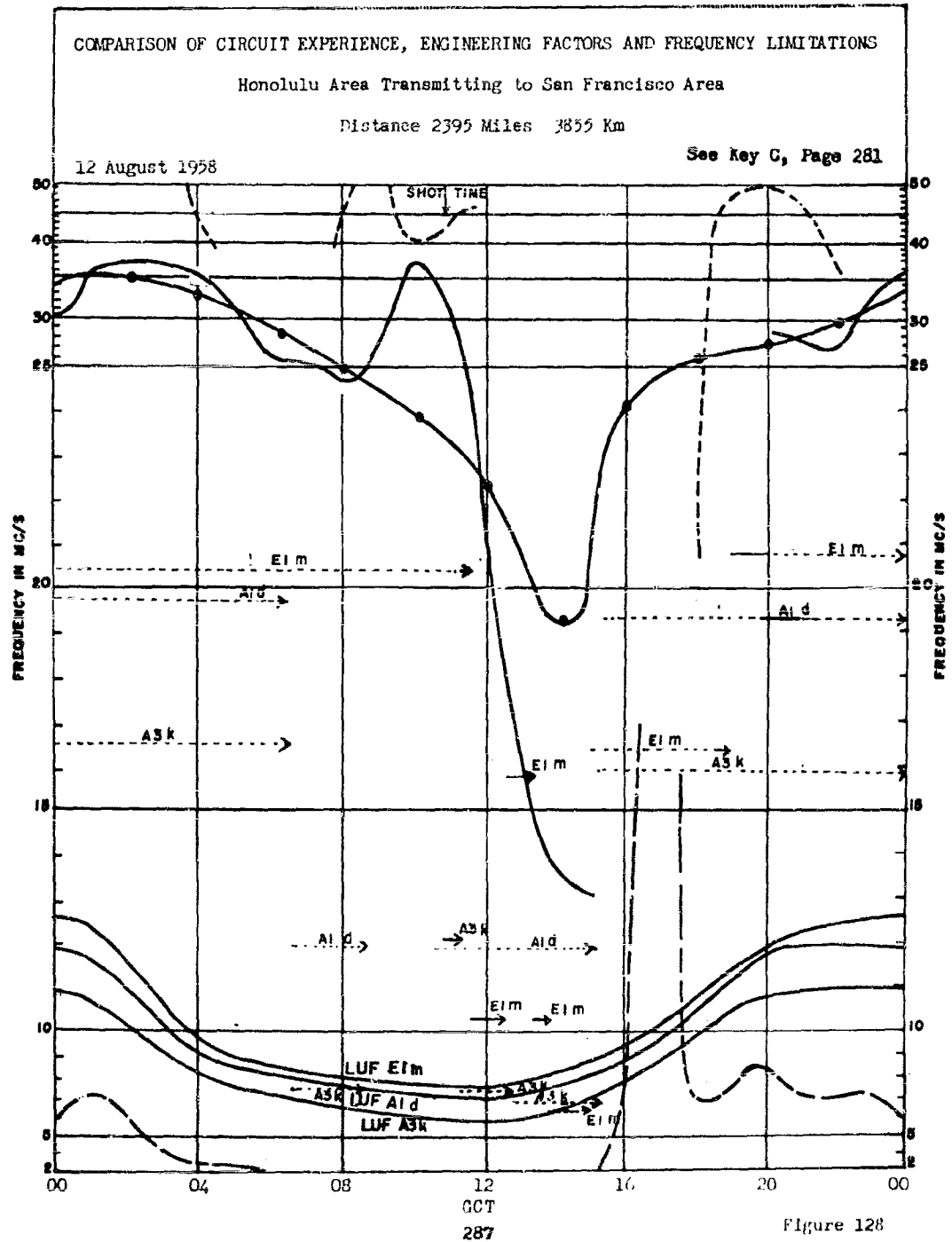


Figure 128

**SECRET**

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TABLE V

Summation of Successes and Failures  
Before and After Shot Time  
San Francisco - Honolulu

Xmtr	Terminal	Recvr	Service	Before Shot				After Shot				Freq	Changes
				Successes	Failures	Hrs	Min	Successes	Failures	Hrs	Min		
TEST TEAK													
San Francisco		Honolulu	AACS-SSB	10	20	0	30	8	55	4	15	5	
			ACAN-CSRTT	10	35	0	15	13	10	0	00	1	
			ACAN-SSB	10	35	0	15	13	10	0	00	3	
Honolulu		San Francisco	AACS-SSB	10	50	0	00	9	25	3	45	1	
			ACAN-CSRTT	10	50	0	00	12	55	0	15	2	
			ACAN-SSB	10	20	0	30	12	55	0	15	3	
TEST ORANGE													
San Francisco		Honolulu	AACS-SSB	10	0	0	30	9	15	4	15	4	
			ACAN-CSRTT	8	0	0	00	10	30	0	00	2	
			ACAN-SSB	10	30	0	00	12	45	0	45	1	
Honolulu		San Francisco	AACS-SSB	10	30	0	00	9	30	4	00	6	
			ACAN-CSRTT	8	30	0	00	12	45	0	30	4	
			ACAN-SSB	8	30	0	00	12	15	1	15	1	

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

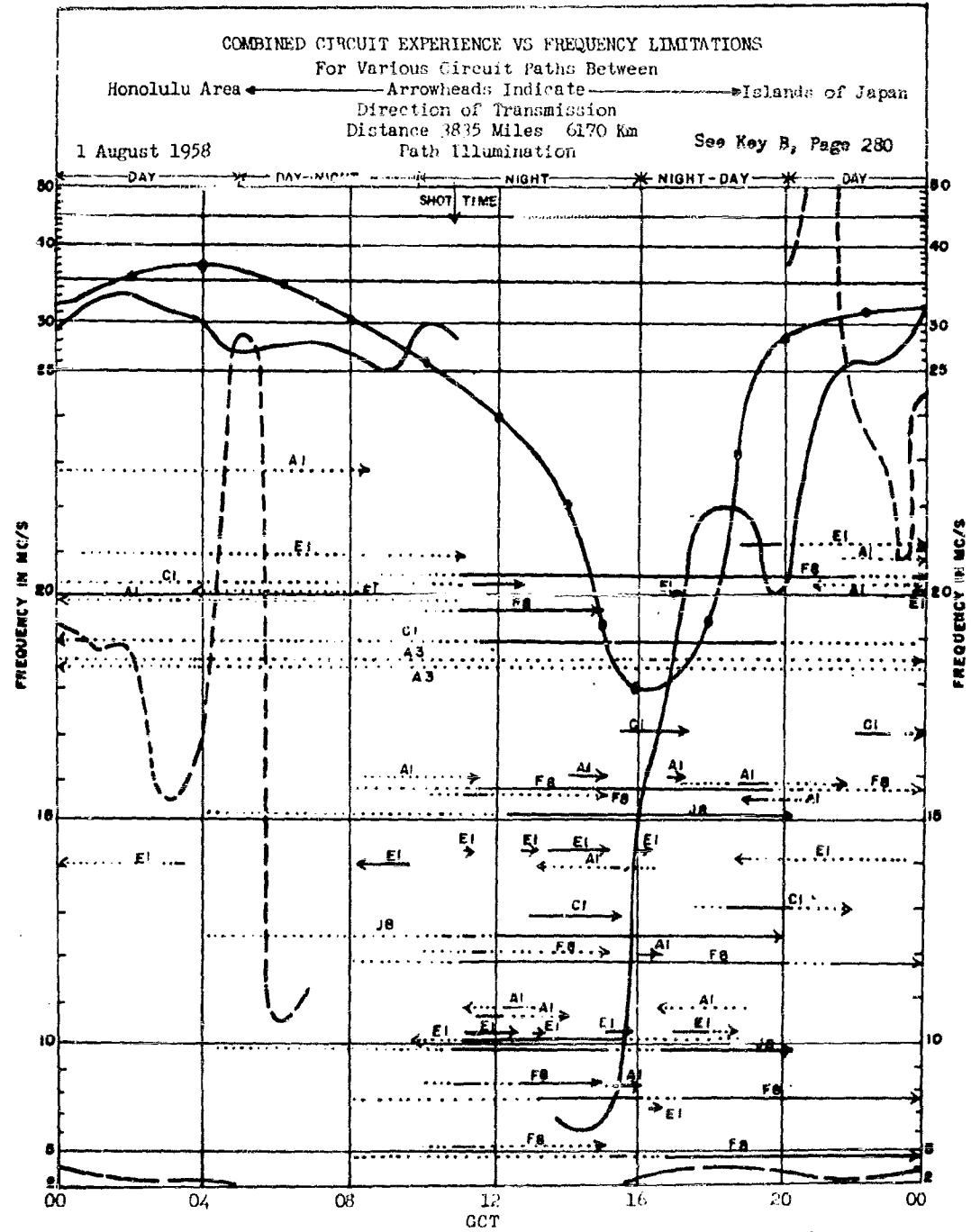
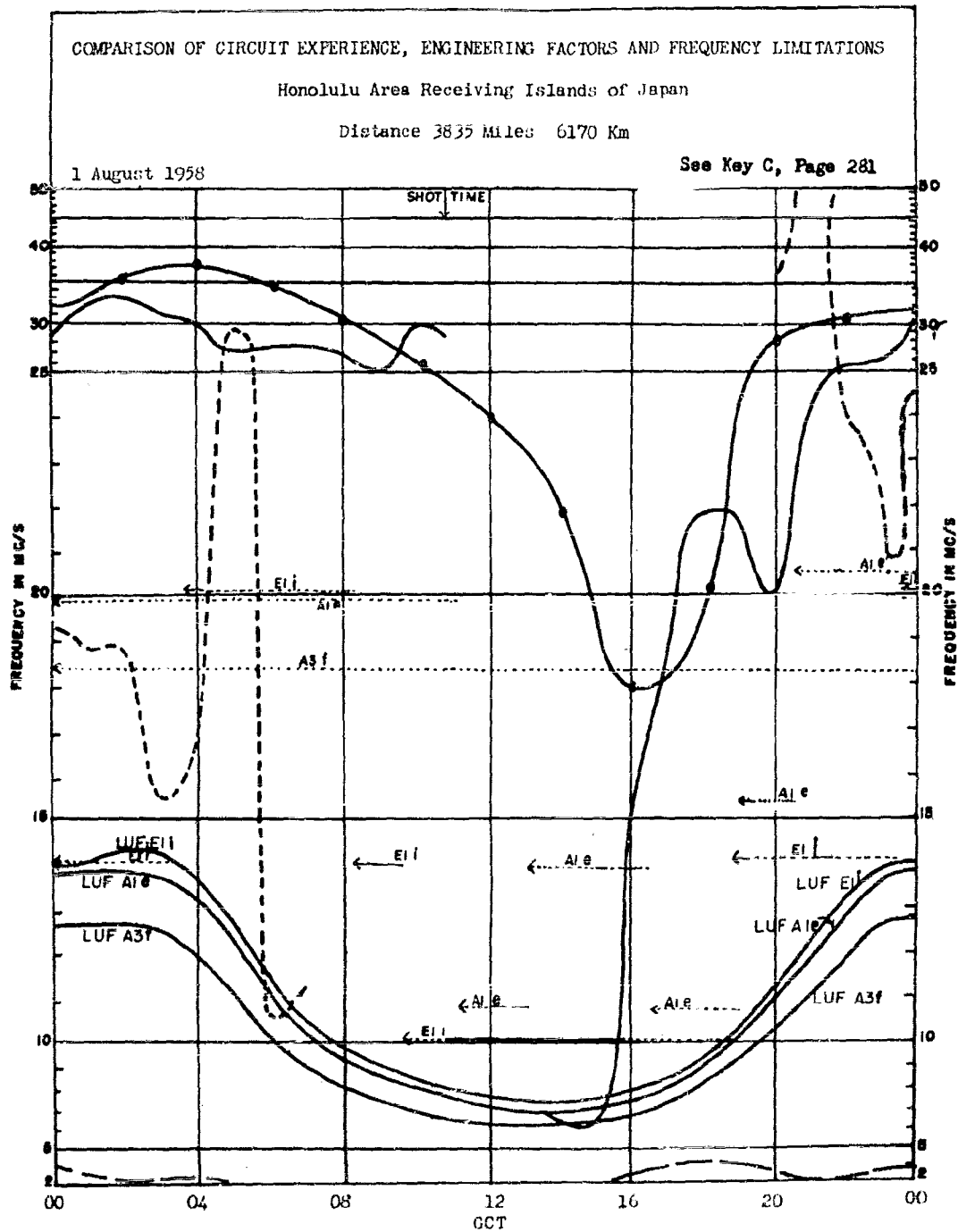


Figure 129

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U. S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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RADIO PROPAGATION AGENCY

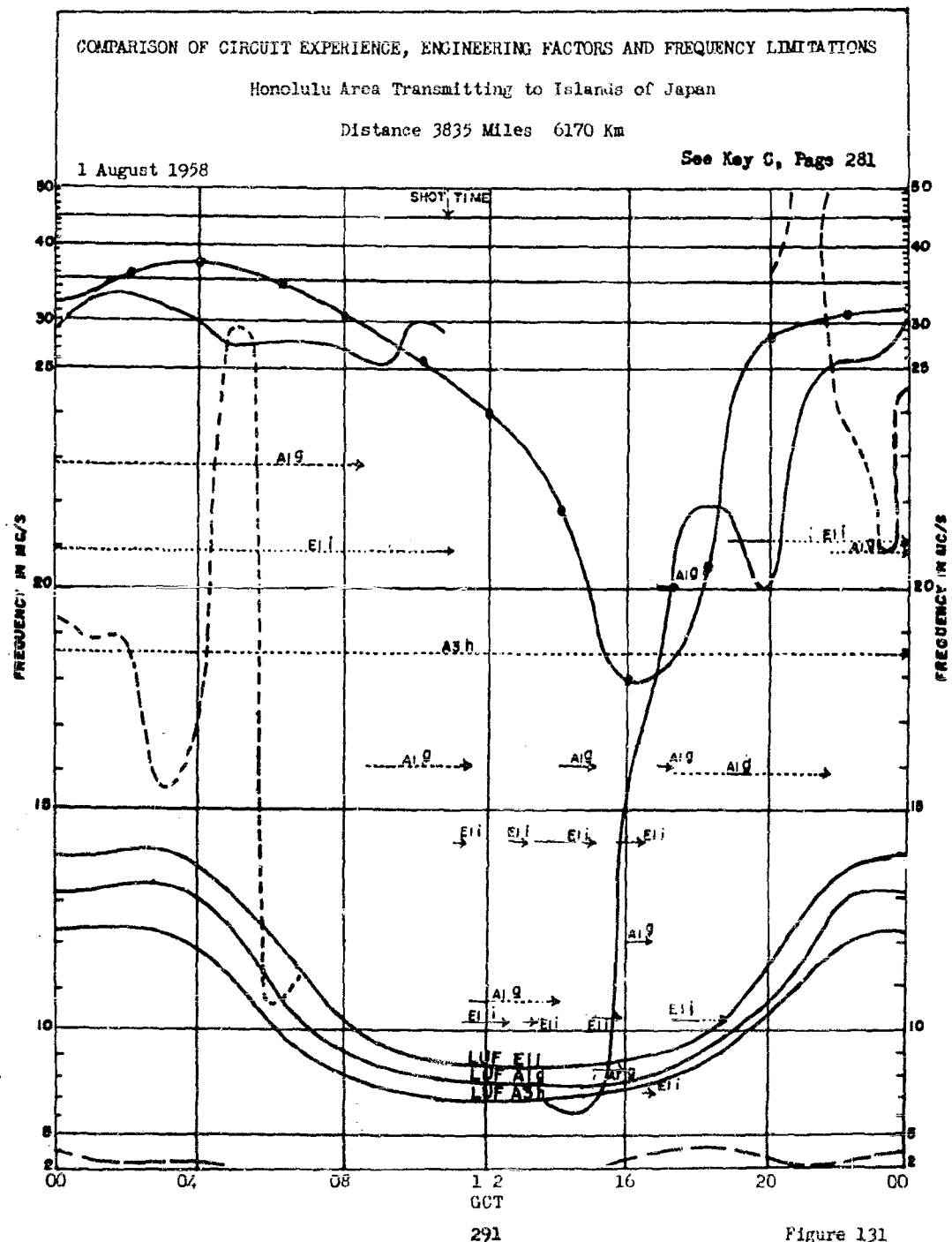


Figure 131

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

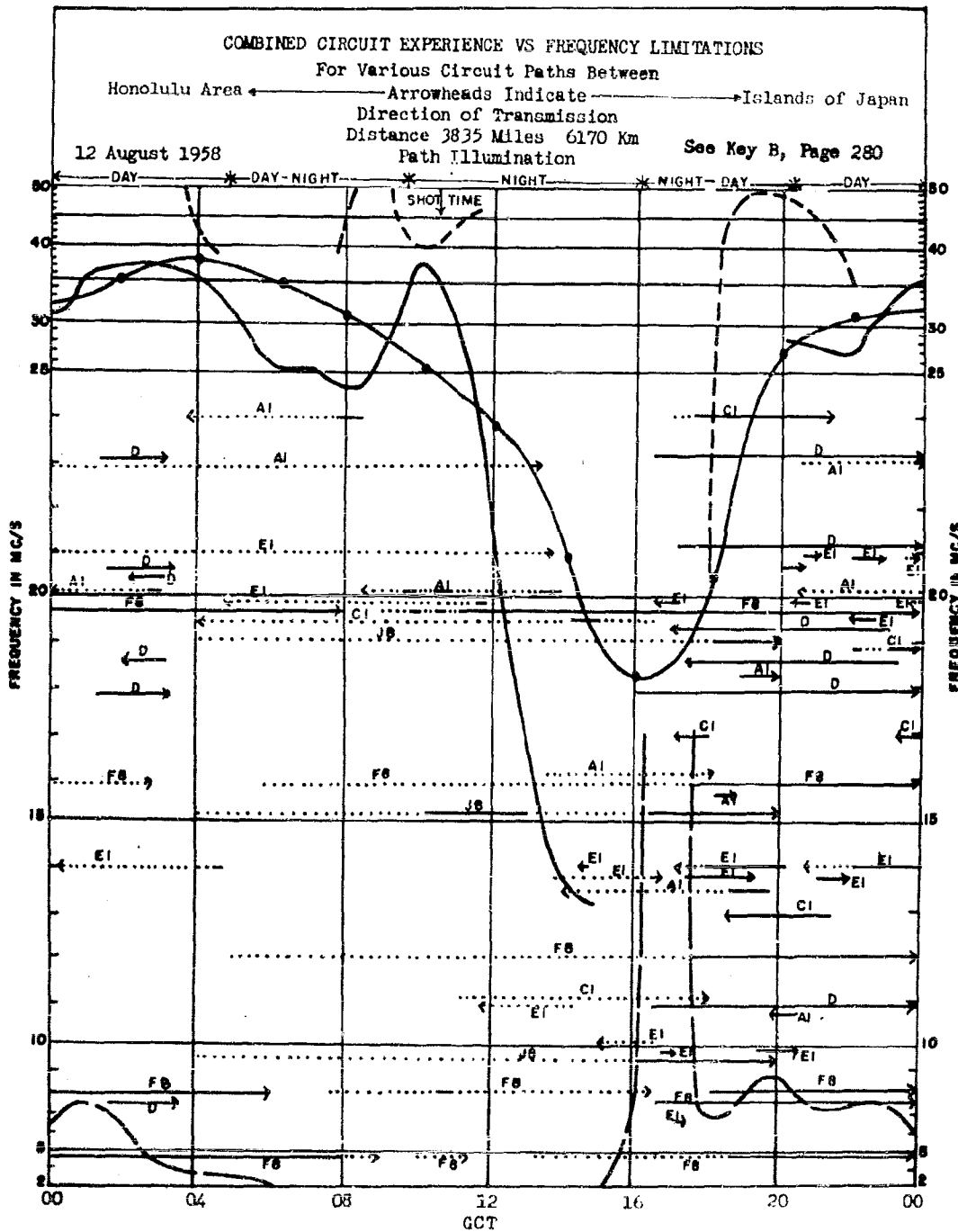
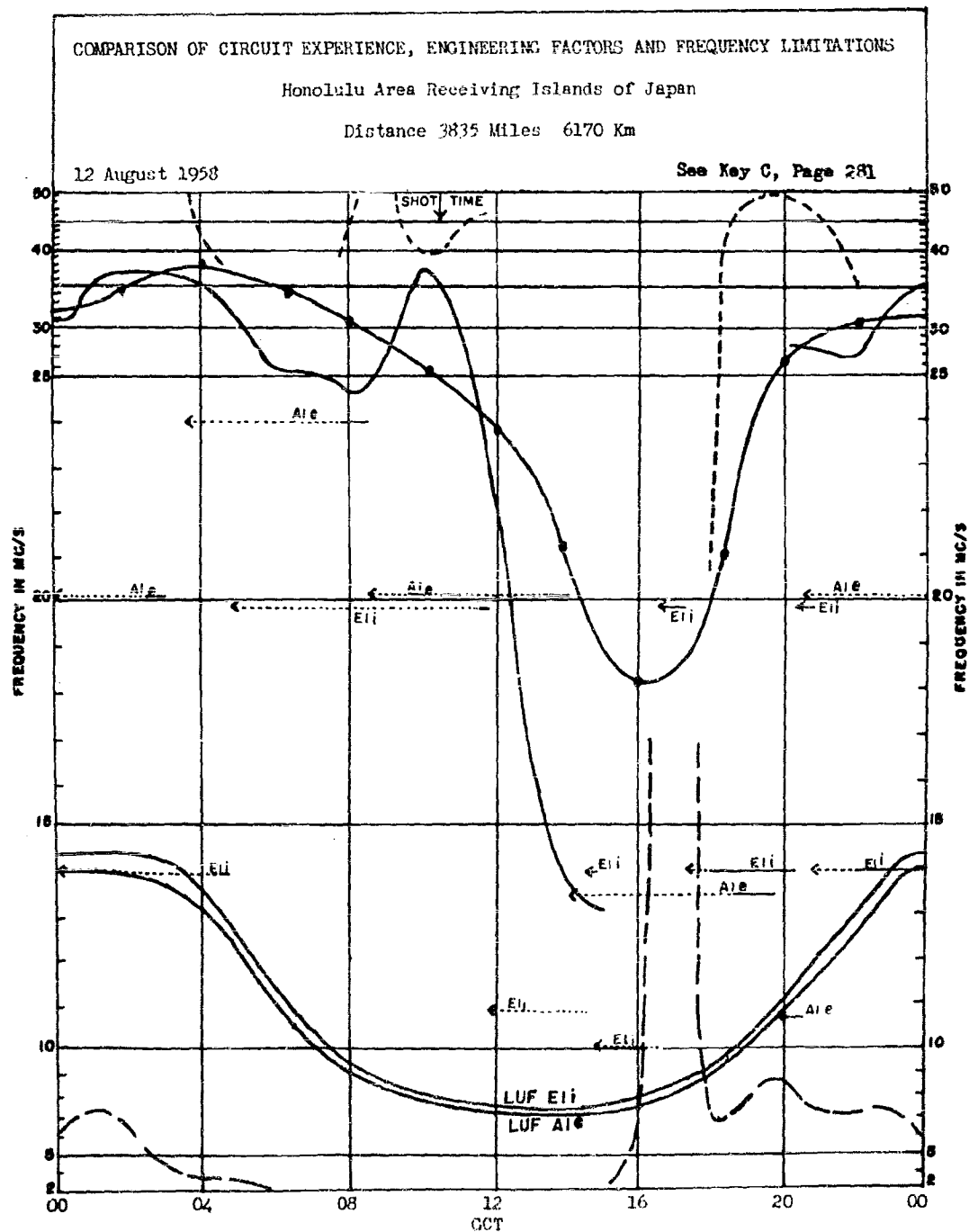


Figure 132

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U.S. ARMY SIGNAL  
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TABLE VI

Summation of Successes and Failures  
Before and After Shot Time  
Tokyo - Honolulu

Xmtr	Terminal	Recvr	Service	Before Shot				After Shot				
				Successes	Failures	Freq	Changes	Successes	Failures	Freq	Changes	
TEST TEAK												
Tokyo		Honolulu	AACS-SSE	9	20	1	30	7	15	5	55	2
			ACAN-CSRTT	10	50	0	00	13	10	0	00	0
			ACAN-SSE	10	50	0	00	11	25	1	45	5
Honolulu		Tokyo	AACS-SSE	10	50	0	00	5	0	8	10	11
			ACAN-CSRTT	10	50	0	00	13	10	0	00	0
			ACAN-SSE	10	35	0	15	7	40	5	30	7
TEST ORANGE												
Tokyo		Honolulu	AACS-SSE	10	15	0	15	7	30	6	00	7
			ACAN-SSE	8	15	1	45	10	15	3	15	3
Honolulu		Tokyo	AACS-SSE	10	30	0	00	5	15	6	45	8
			ACAN-SSE	10	30	0	00	10	45	2	45	5

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U S ARMY SIGNAL  
RADIO PROPAGATION AGENCY

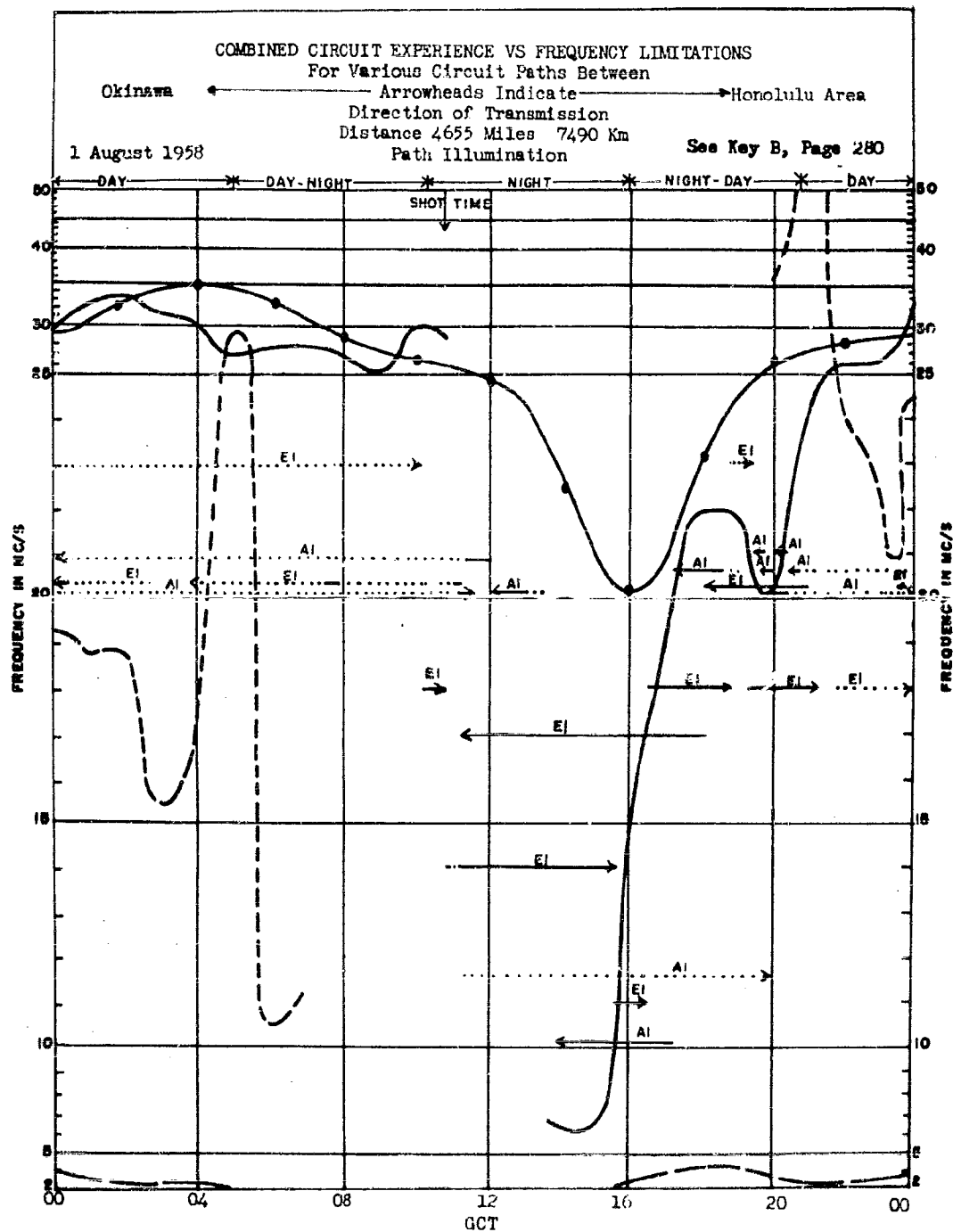
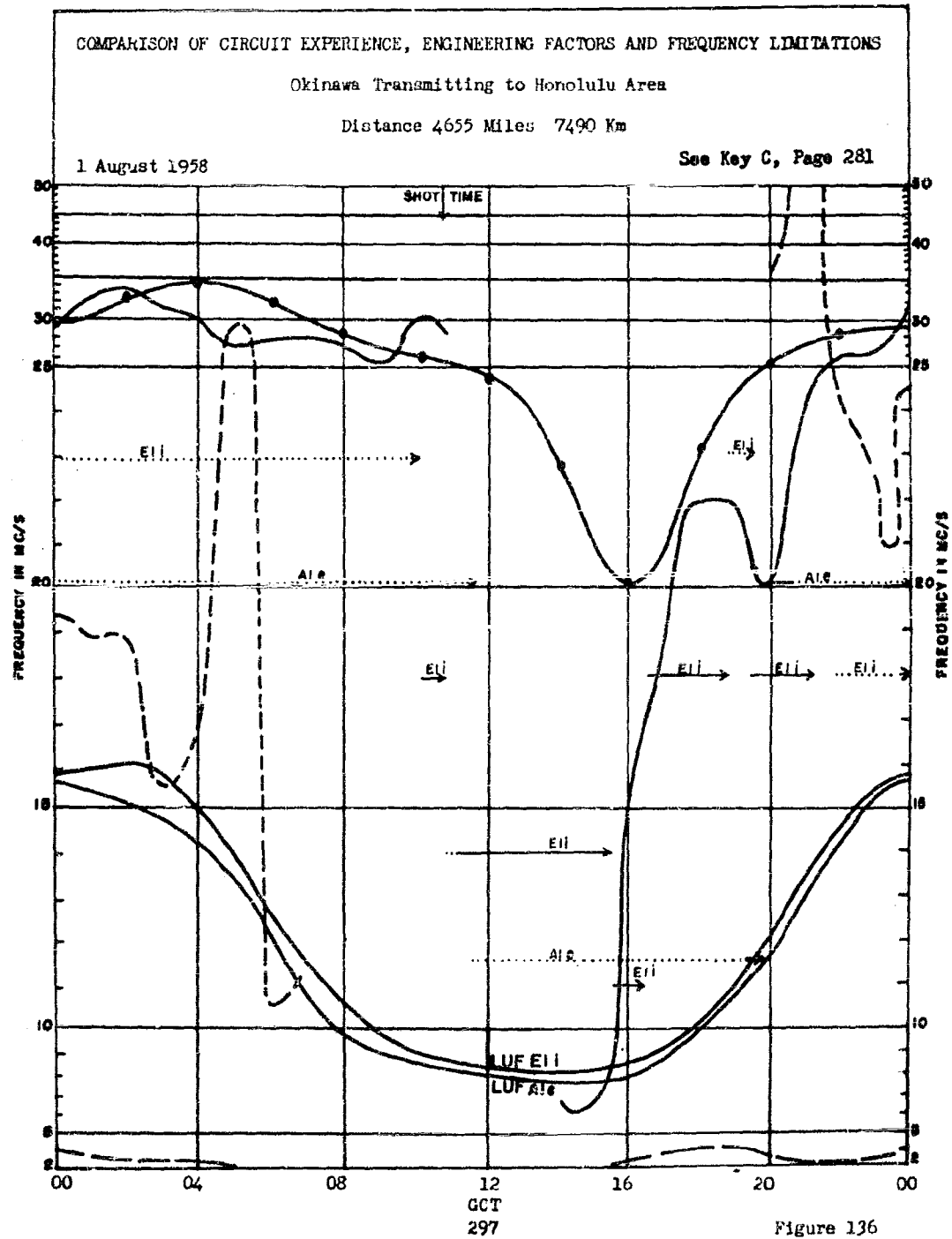


Figure 135

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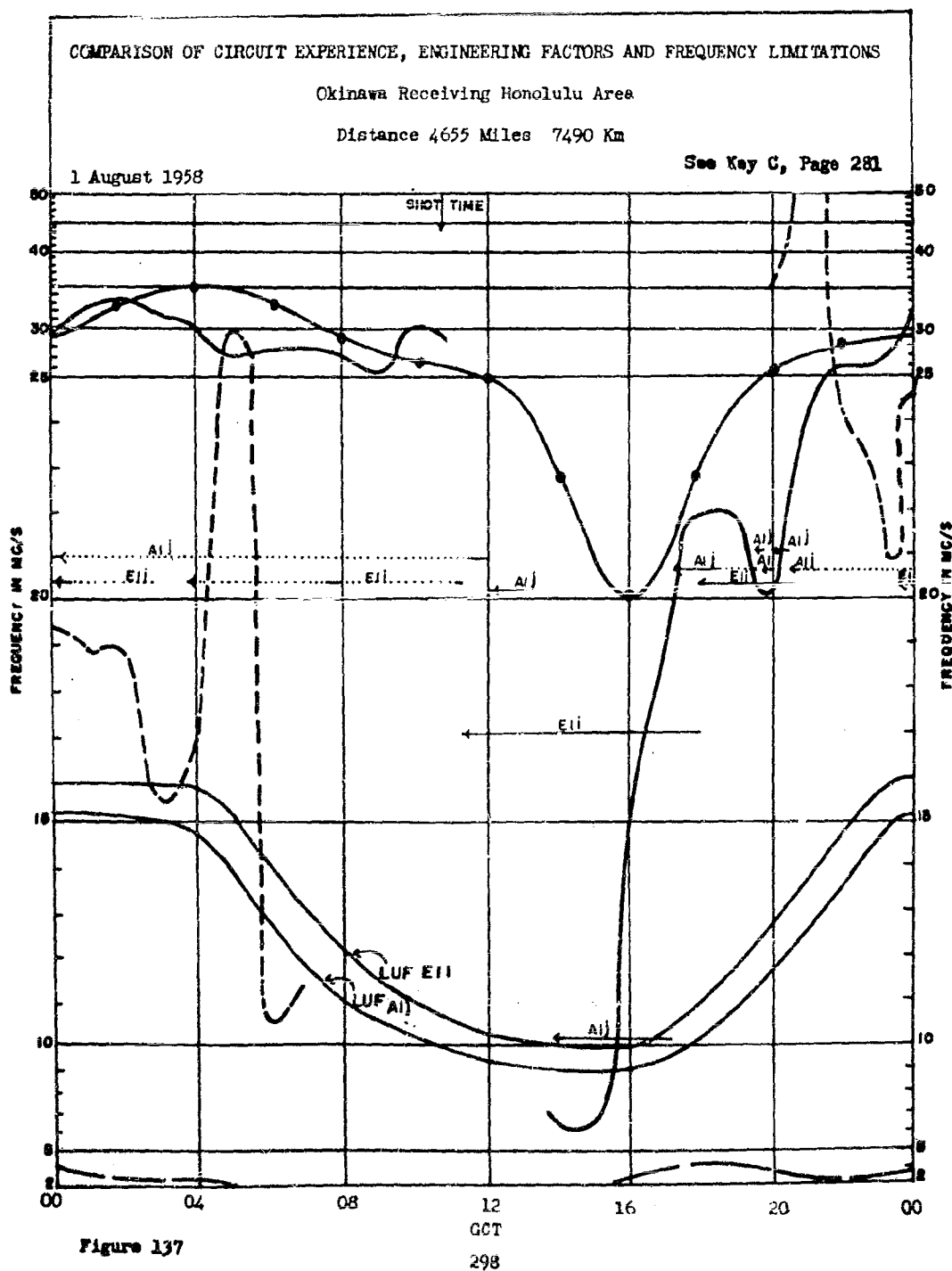
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RADIO PROPAGATION AGENCY



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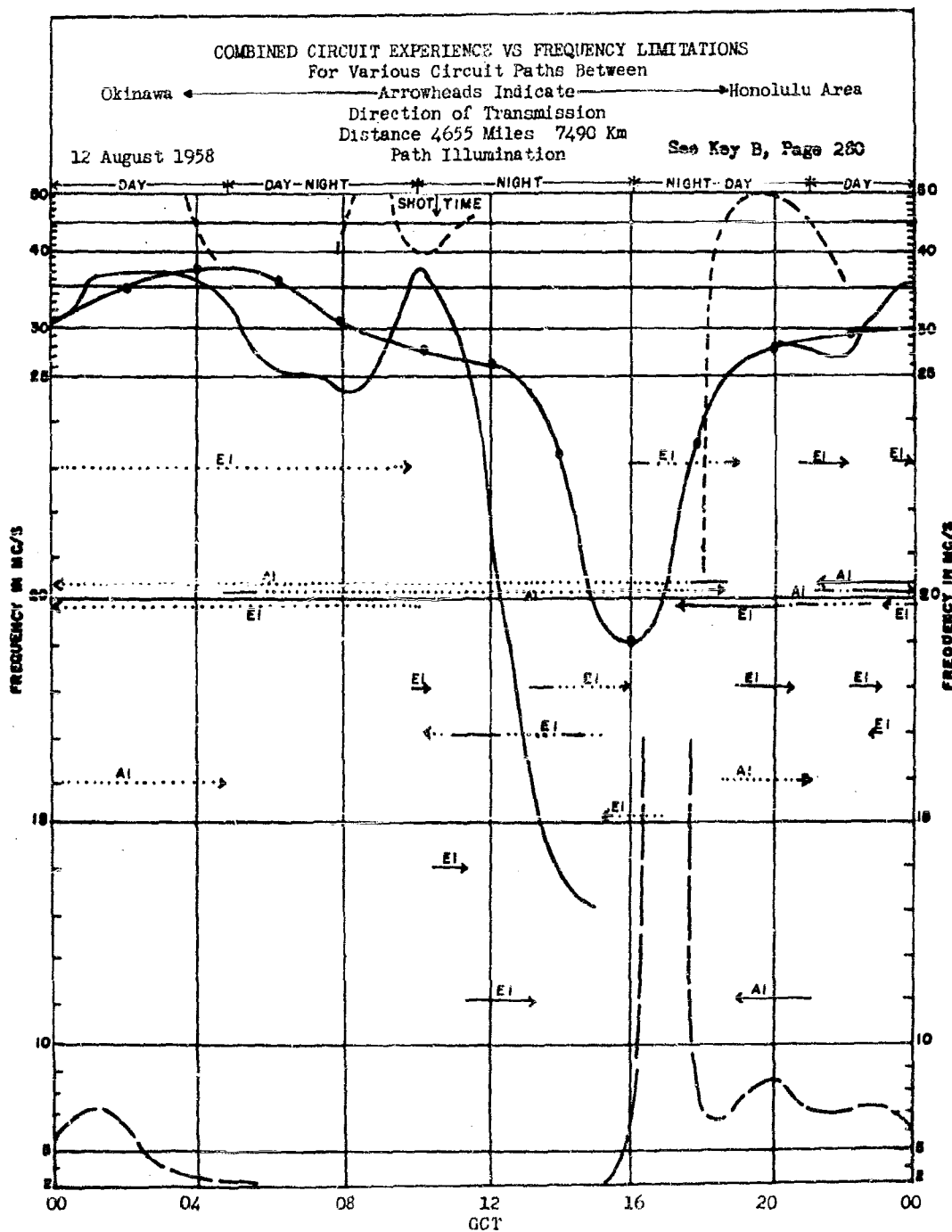
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RADIO PROPAGATION AGENCY



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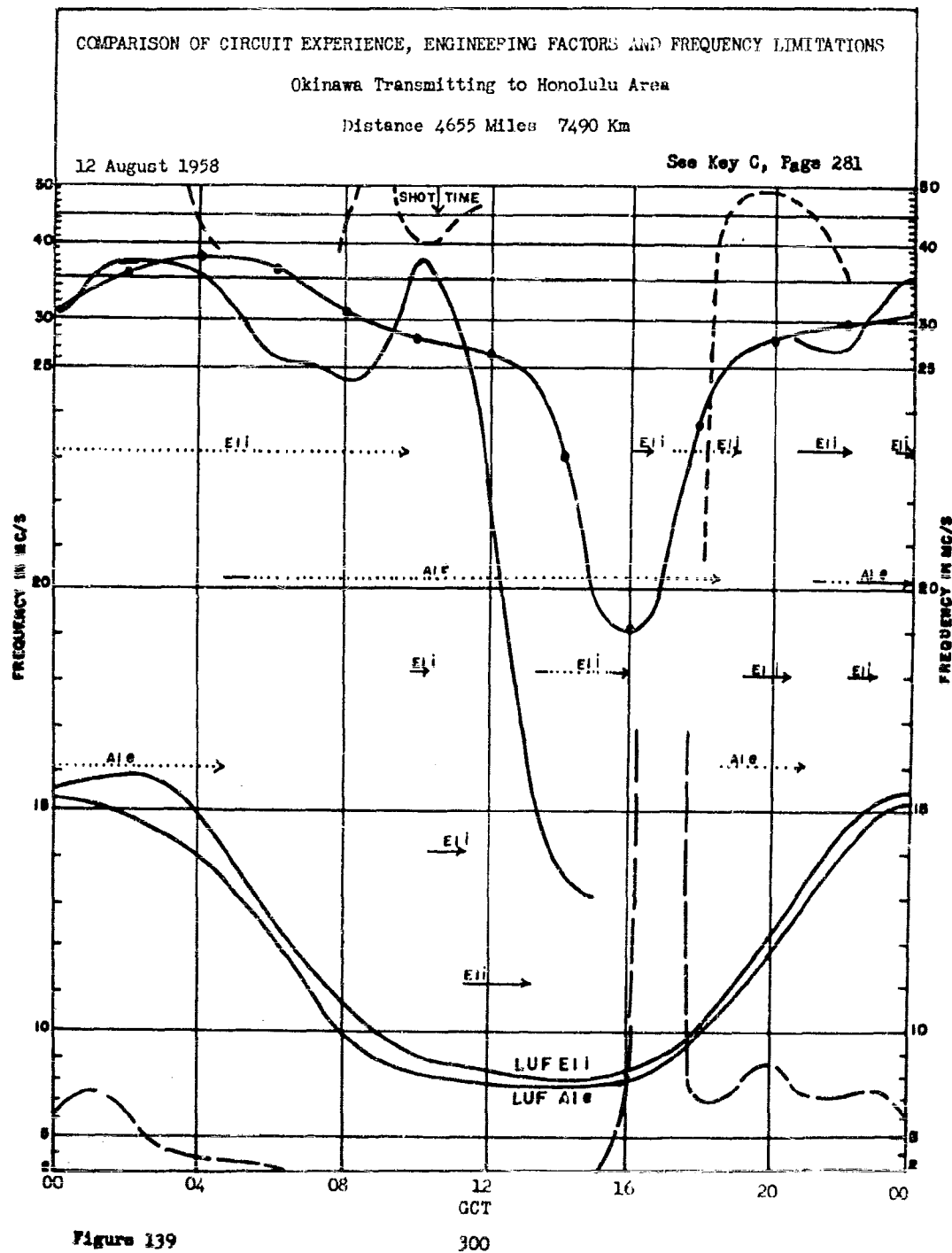
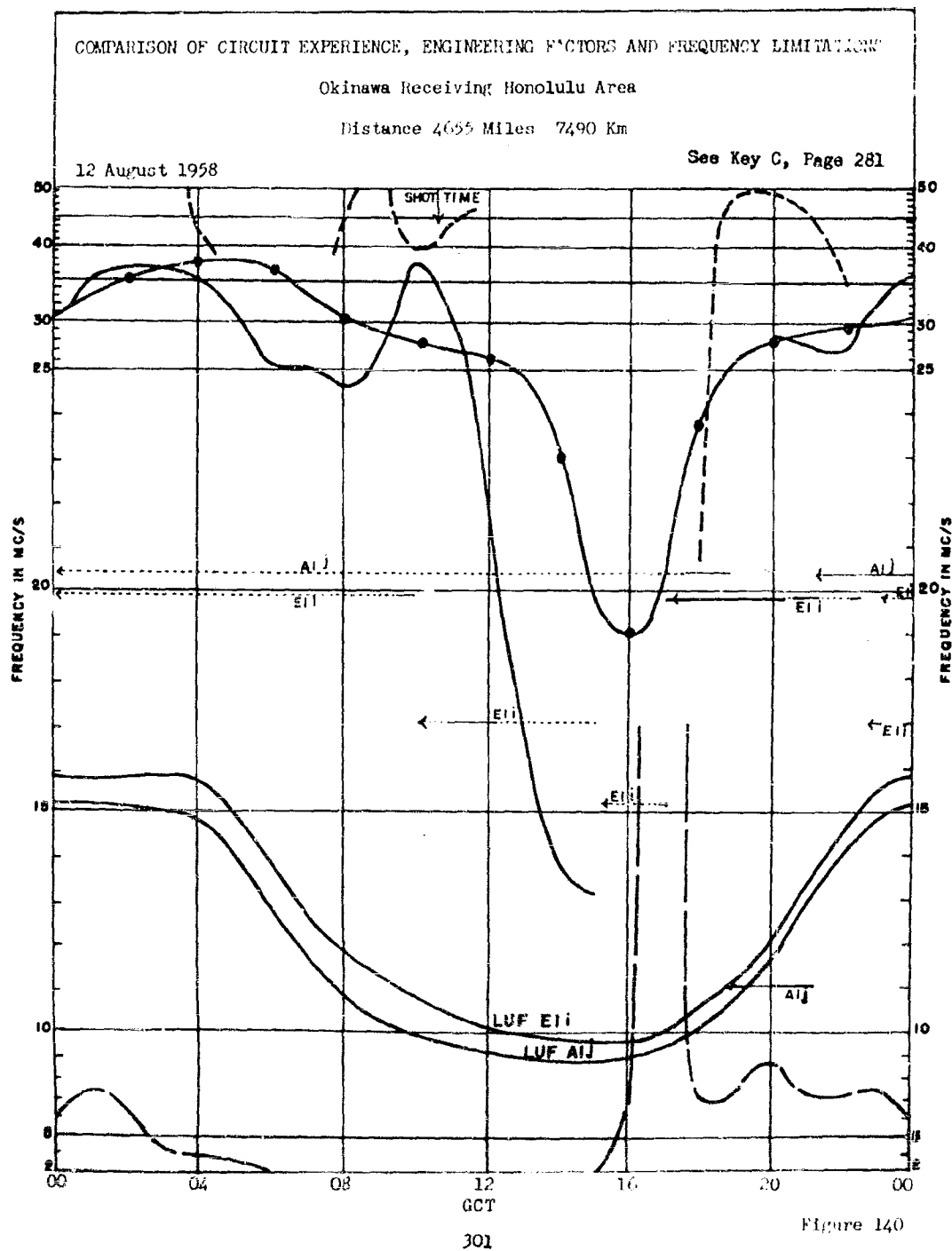


Figure 139

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U.S. ARMY SIGNAL  
RADIO PROPAGATION AGENCY



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TABLE VII

Summation of Successes and Failures  
Before and After Shot Time  
Okinawa - Honolulu

Xmtr	Terminal	Recv	Service TEST TEAK	Before Shot			After Shot			Freq Changes	Successes			Failures			Freq Change
				Hrs	Min	Hrs Min	Hrs	Min	Hrs Min		Hrs	Min	Hrs Min	Hrs	Min	Hrs Min	
Okinawa		Honolulu	AACS-SSB ACAN-SSB	10	00	0 45	10	00	9 30	1	3	10	9 30	5			5
				10	50	0 00	12	10	1 00	0				2			
Honolulu		Okinawa	AACS-SSB ACAN-SSB	8	50	1 00	0	00	10 00	0	0	40	10 00	2			2
				10	50	0 00	5	25	7 45	0				7			7
TEST ORANGE																	
Okinawa		Honolulu	AACS-SSB ACAN-SSB	9	45	0 45	3	30	9 00	2	3	30	9 00	7			7
				9	45	0 45	10	30	3 00	1	10	30	3 00	2			2
Honolulu		Okinawa	AACS-SSB ACAN-SSB	10	00	0 30	6	15	7 15	1	6	15	7 15	4			4
				10	30	0 0	7	00	6 30	0	7	00	6 30	2			2

KEY TO COMBINED CIRCUIT EXPERIENCE CHART

u. satisfactory

Arrowheads on circuit bars indicate direction of traffic flow. Arrow directed to left signifies reception by the first terminal mentioned on chart heading.

length of bar corresponds to duration of circuit condition.

Receiving Agency

A - ACAN

The Agency  
E.O. AACS

Type of Service

1. a. SCB

2 = Speech

3 - CS RTT


User's Designation

(1) = Circuit #1

(2) = CATERPILLAR #2

(3) = Circuit #3

Example: B 2 (3) = AIGT Radiotelephone  
Circuit Number 3

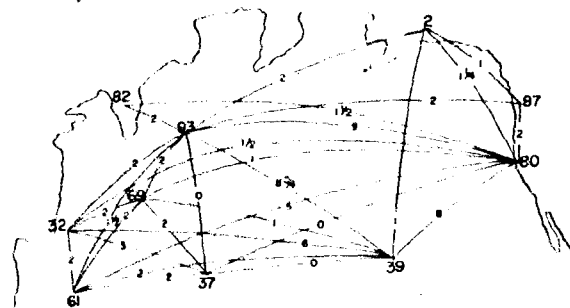
Frequency limitation: Predicted Monthly Median MFF:  (applies to undisturbed days within a 30 day period centered on test)

Upper Solid Curve: Reliability of circuit under conditions of multiple parallel relaying in frequency-hours per hour

Lower Solid Curve: Capability of circuit with no parallel relaying in frequency bands not shown

Dotted Curve: Total frequency-hours attempted per hour

Location and performance of relay network links



## 2. ANCHORAGE

## 12. FORMOSA

17- (NAME)

39. НАКАЛ

61. VANILLA

62 GRINAM

80. SAN FRANCISCO

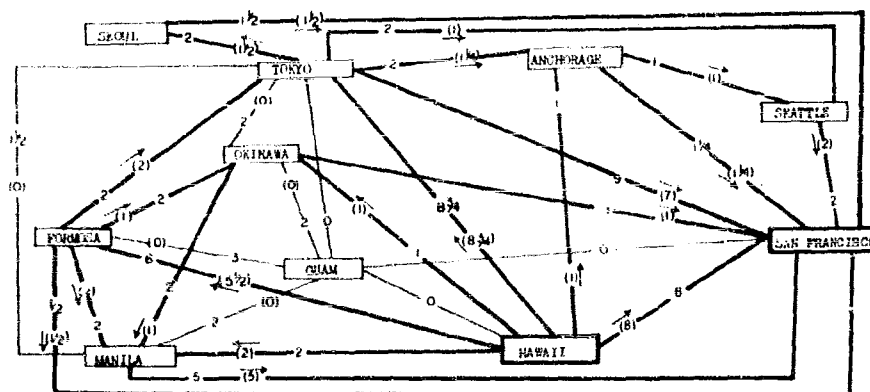
## 8.2. SEOML

87 SPATTLE

## 94. TOKYO

Relay network diagram showing contribution of individual links.

Relay network diagram showing contribution of individual links.  
Numbered arrows indicate direction and magnitude of individual contributions to relaying when all traffic is assumed to originate at Hawaii. All capabilities and contributions are in frequency hours.



## 303

Figure 141

**Key on Page 303**

**Circuit Capability**

Frequency-hours per Hour

Successful Direct plus Relayed

Attempted Direct

Successful Direct

Time (Hours)	Successful Direct plus Relayed	Attempted Direct	Successful Direct
00	28	12	12
02	33	15	15
04	33	14	14
06	38	15	15
08	45	18	18
10	38	12	12
12	28	10	10
14	23	12	12
16	26	10	10
18	32	15	15
20	38	18	18
22	42	18	18
24	40	15	15

304

# SECRET

## KEY TO COMBINED CIRCUIT EXPERIENCE CHART

### Circuit Experience:

Reception Satisfactory.....  
Unsatisfactory.....

Entry of Satisfactory refers to periods of reported successful reception. Entry of Unsatisfactory refers to periods of reported outage definitely attributed to propagation conditions. All other interruptions or unreported periods result in omission of entry.

Arrowheads on circuit bars indicate direction of traffic flow. Arrow directed to left signifies reception by the first terminal mentioned on chart heading.

Length of bar corresponds to duration of circuit condition.

### Data Identification Code:

Receiving Agency	Type of Service	User's Designation
A = ACAN	1 = SCB	(1) = Circuit #1
B = AT&T	2 = Speech	(2) = Circuit #2
C = US NAVY	3 = CS RTT	(3) = Circuit #3
D = GAA	4 = MUX 4-ch	(4) = Circuit #4
E = AACS	7 = 2 ch RTT	
G = RCA		
H = Maskey Radio		
I = Globe Radio		

Example: B 2 (3) = AT&T Radiotelephone Circuit Number 3

Frequency limitation: Predicted Monthly Median MUF: (applies to undisturbed days within a 10 day period centered on test)

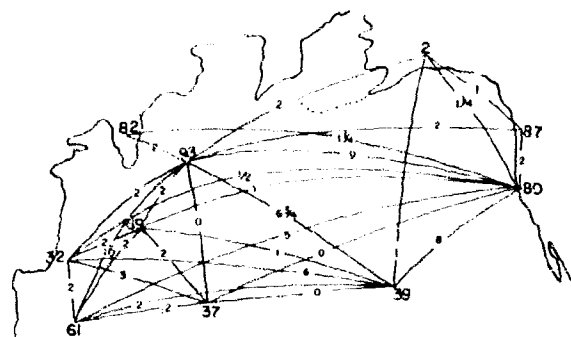
## KEY TO CIRCUIT CAPABILITY CHART

Upper Solid Curve: Capability of circuit under conditions of multiple parallel relay in frequency-hours per hour

Lower Solid Curve: Capability of circuit with no parallel relay in frequency-hours per hour

Dotted Curve: Total frequency-hours attempted per hour

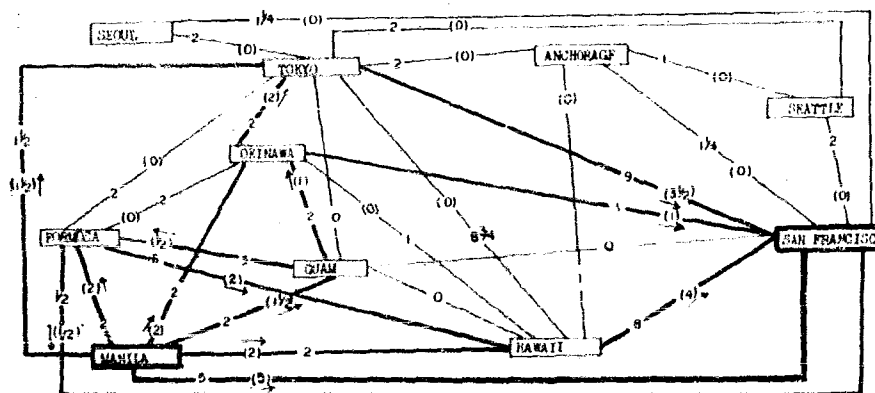
MULTIPLE PARALLEL RELAYING AT 1200Z BETWEEN MANILA AND SAN FRANCISCO ON 1 AUGUST 1958  
Location and performance of relay network links.



### KEY TO TERMINAL LOCATIONS:

- 2. ANCHORAGE
- 32. PUSAN
- 37. GUAM
- 39. HAWAII
- 61. MANILA
- 69. OKINAWA
- 80. SAN FRANCISCO
- 82. SEOUL
- 87. SEATTLE
- 91. TOKYO

Relay network diagram showing contributions of individual links.  
Numbered arrows indicate direction and magnitude of individual contributions to relaying when all traffic is assumed to originate at Manila. All capabilities and contributions are in frequency hours



SECRET

# **SECRET** **INCREASED CIRCUIT CAPABILITIES** **FROM** **ASSUMPTION OF MULTIPLE RELAYING**

1 August 1958

Manila-----San Francisco

Key on Page 305

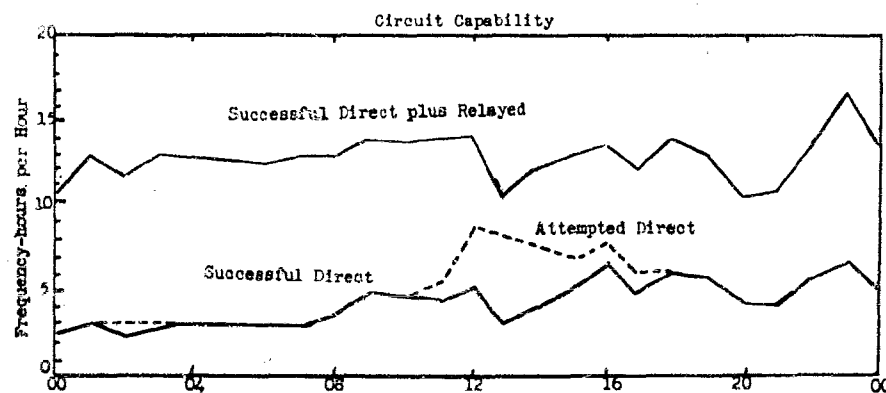
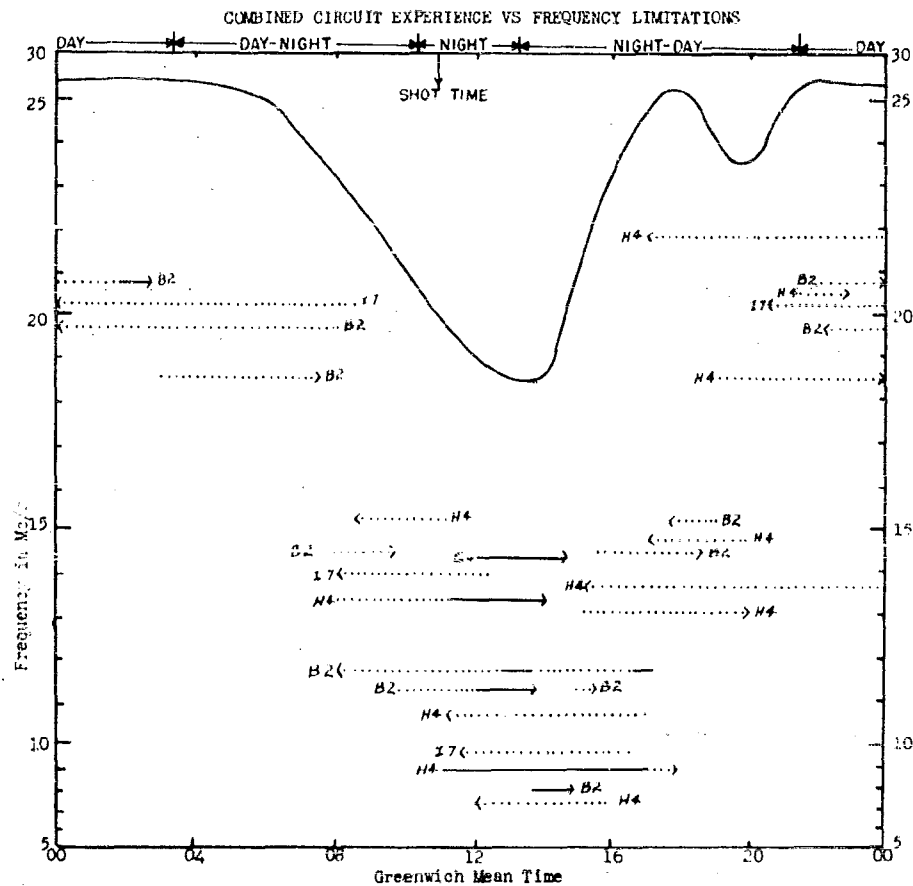


Figure 144

**SECRET**

# SECRET

## KEY TO COMBINED CIRCUIT EXPERIENCE CHART

Circuit Experience:  
Reception Satisfactory.....  
Unsatisfactory.....

Entry of Satisfactory refers to periods of reported successful reception. Entry of Unsatisfactory refers to periods of reported outage definitely attributed to propagation conditions. All other interruptions or unreported periods result in omission of entry.

Arrowheads on circuit bars indicate direction of traffic flow. Arrow directed to left signifies reception by the first terminal mentioned on chart heading.

Length of bar corresponds to duration of circuit condition.

### Data Identification Code:

Receiving Agency	Type of Service	Group's Designation
A = ACAN	1 = SSB	7 = 7 ch RTT
B = AT&T	2 = Speech	(1) = Circuit #1
C = US Navy	3 = CS RTT	(2) = Circuit #2
D = CAA	4 = MIX 4-ch	(3) = Circuit #3
		(4) = Circuit #4

Example: B 2 (3) = AT&T Radiotelephone Circuit Number 3

Frequency Limitation: Predicted Monthly Median MUF: ~~~~~ (applies to undisturbed days within a 30 day period centered on test)

## KEY TO CIRCUIT CAPABILITY CHART

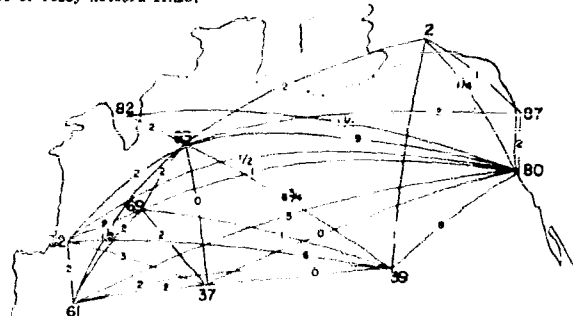
Upper Solid Curve: Capability of circuit under conditions of multiple parallel relaying in frequency-hours per hour

Lower Solid Curve: Capability of circuit with no parallel relaying in frequency-hours per hour

Dotted Curve: Total frequency-hours attempted per hour

## MULTIPLE PARALLEL RELAYING AT 1700Z BETWEEN GUAM AND HAWAII ON 1 AUGUST 1958

Location and performance of relay network links.

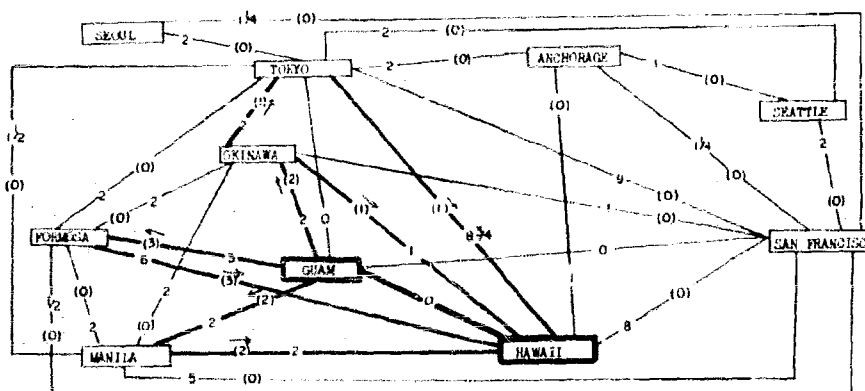


### KEY TO TERMINAL LOCATIONS

- 2. ANCHORAGE
- 32. FORMOSA
- 37. GUAM
- 39. HAWAII
- 61. MANILA
- 69. OKINAWA
- 80. SAN FRANCISCO
- 84. SEOUL
- 87. SEATTLE
- 93. TOKYO

### Relay network diagram showing contribution of individual links.

Numbered arrows indicate direction and magnitude of individual contributions to relaying when all traffic is assumed to originate at Guam. All capabilities and contributions are in frequency hours.



SECRET

# **SECRET** **INCREASED CIRCUIT CAPABILITIES** **FROM** **ASSUMPTION OF MULTIPLE RELAYING**

1 August 1958

Guam-----Hawaii

Key on Page 307

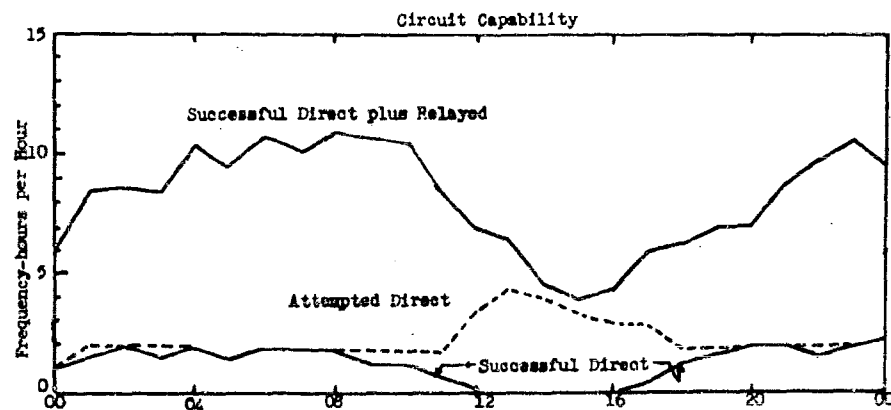
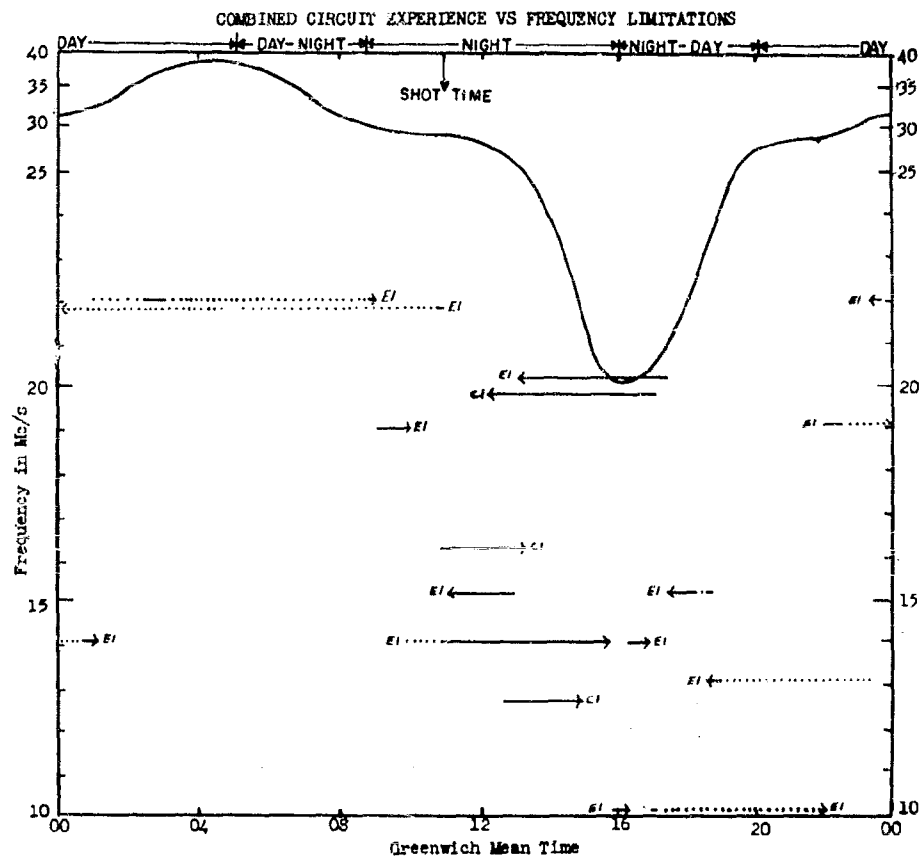


Figure 146

**SECRET**  
308

# SECRET

## KEY TO COMBINED CIRCUIT EXPERIENCE CHART

Circuit Experience:  
Reception      Satisfactory .....  
                 Unsatisfactory .....

Entry of Satisfactory refers to periods of reported successful reception. Entry of Unsatisfactory refers to periods of reported outage definitely attributed to propagation conditions. All other interruptions or unreported periods result in omission of entry.

Arrowheads on circuit bars indicate direction of traffic flow. Arrow directed to left signifies reception by the first terminal mentioned on chart heading.

Length of bar corresponds to duration of circuit condition.

### Data Identification Code:

Receiving Agency	Type of Service	User's Designation
A = ACAN	1 = SOB	(1) = Circuit #1
B = ARMY	2 = Speech	(2) = Circuit #2
C = US NAVY	3 = CB RTT	(3) = Circuit #3
D = CAA	4 = MEX 4-sh	(4) = Circuit #4
E = AACS	5 = 2 sh RTT	
F = RCA		
G = Mackay Radio		
H = Globe Radio		

Example: B 2 (3) = ARMY Radio-telephone circuit Number 3

Frequency limitation: Predicted Monthly Median MUF: ~~~~~ (applies to undisturbed days within a 30 day period centered on test)

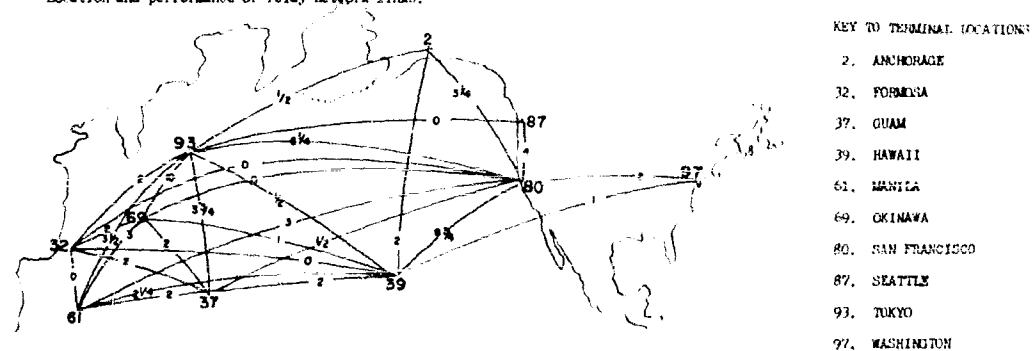
## KEY TO CIRCUIT CAPABILITY CHART

Upper Solid Curve: Capability of circuit under conditions of multiple parallel relay in frequency-hours per hour

Lower Solid Curve: Capability of circuit with no parallel relay in frequency-hours per hour

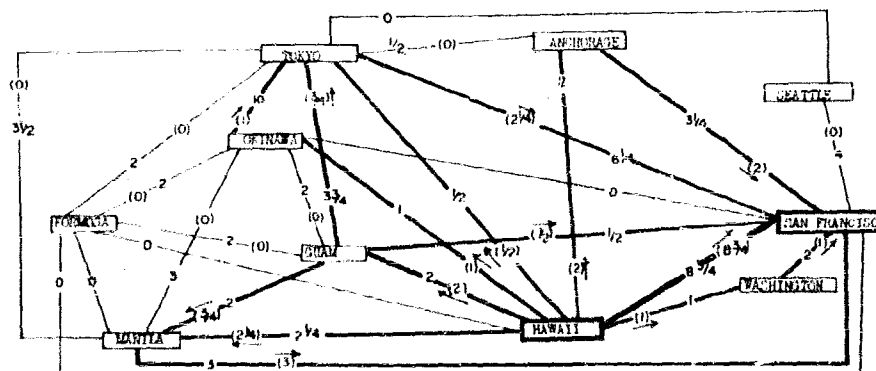
Dotted Curve: Total frequency-hours attempted per hour

MULTIPLE PARALLEL RELAYING AT 1900Z BETWEEN HAWAII AND SAN FRANCISCO ON 12 AUGUST 1958  
Location and performance of relay network links.



Relay network diagram showing contributions of individual links.

Numbered arrows indicate direction and magnitude of individual contributions to relaying when all traffic is assumed to originate at Manila. All capabilities and contributions are in frequency hours.



SECRET

# **SECRET** **INCREASED CIRCUIT CAPABILITIES** **FROM** **ASSUMPTION OF MULTIPLE RELAYING**

12 August 1958

Hawaii-----San Francisco

Key on Page 309

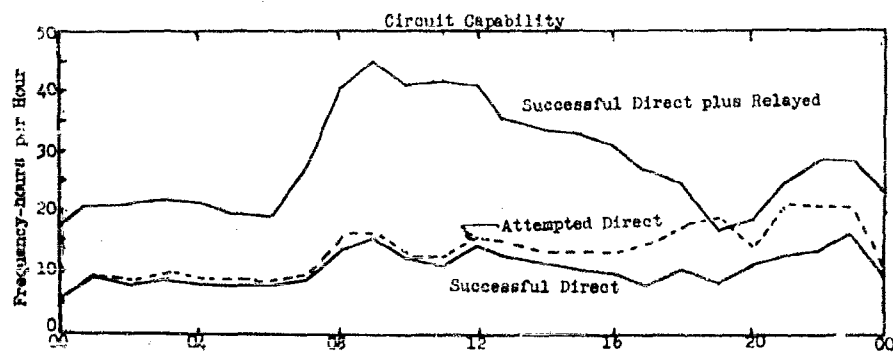
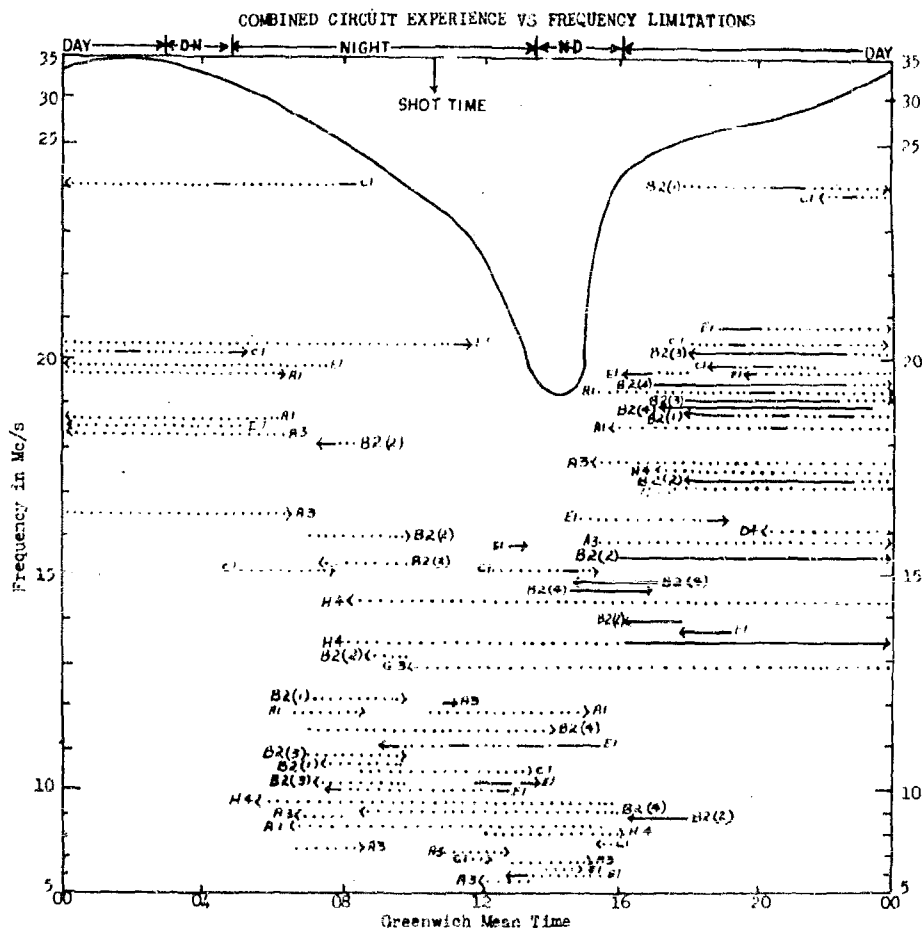


Figure 148

**SECRET**

# SECRET

## KEY TO COMBINED CIRCUIT EXPERIENCE CHART

### Circuit Experience:

Reception      Satisfactory.....  
                  Unsatisfactory.....

Entry of Satisfactory refers to periods of reported successful reception. Entry of Unsatisfactory refers to periods of reported outage definitely attributed to propagation conditions. All other interruptions or unreported periods result in omission of entry.

Arrowheads on circuit bars indicate direction of traffic flow. Arrow directed to left signifies reception by the first terminal mentioned on chart heading.

Length of bar corresponds to duration of circuit condition.

### Data Identification Code:

Receiving Agency	Type of Service	User's Designation
A = ACAN    E = AACS	1 = SCH    7 = 2 ch RTT	(1) - Circuit #1
B = AT&T    G = RCA	2 = Speech	(2) - Circuit #2
C = US NAVY    H = Mercury Radio	3 = CS RTT	(3) - Circuit #3
D = CAA    I = Globe Radio	4 = MUX 4-ch	(4) - Circuit #4

Example: H (1) = AT&T Radio-telephone Circuit Number 1

Frequency limitation: Predicted Monthly Median MUF: \_\_\_\_\_ (applies to undisturbed days within a 30 day period centered on test)

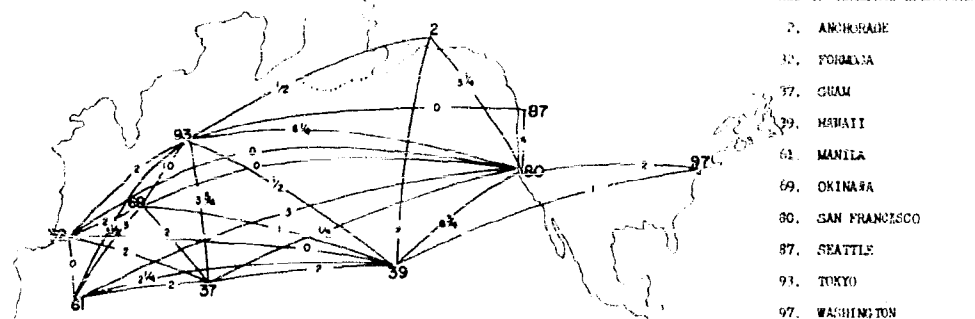
## KEY TO CIRCUIT CAPABILITY CHART

Upper Solid Curve: Capability of circuit under conditions of multiple parallel relay in frequency-hours per hour

Lower Solid Curve: Capability of circuit with no parallel relay in frequency-hours per hour

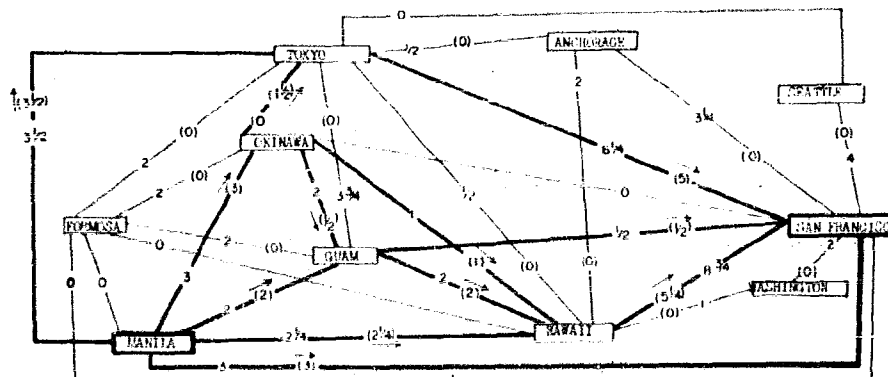
Dotted Curve: Total frequency-hours attempted per hour

MULTIPLE PARALLEL RELAYING AT 1300Z BETWEEN MANILA AND SAN FRANCISCO ON 12 AUGUST 1958  
 location and performance of relay network links.



Relay network diagram showing contributions of individual links.

Numbered arrows indicate direction and magnitude of individual contributions to relaying when all traffic is assumed to originate at Manila. All capabilities and contributions are in frequency hours



SECRET

# **SECRET** **INCREASED CIRCUIT CAPABILITIES** **FROM** **ASSUMPTION OF MULTIPLE RELAYING**

12 August 1958

Manila-----San Francisco

Key on Page 311

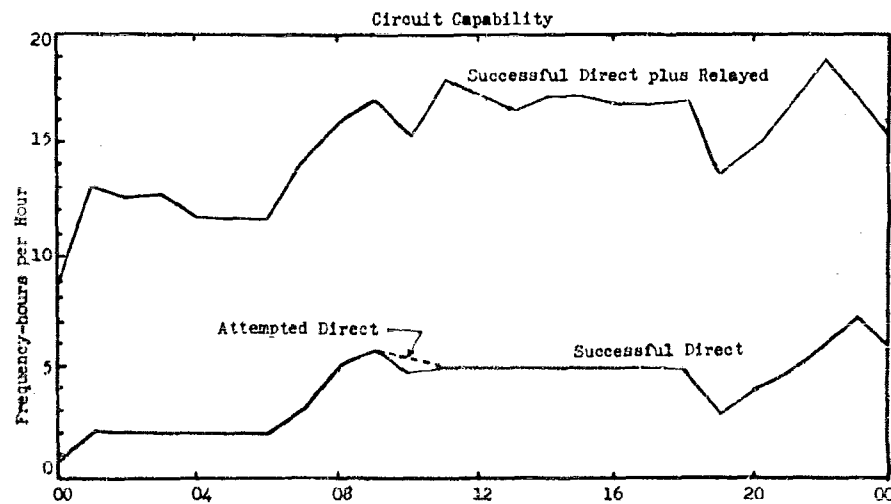
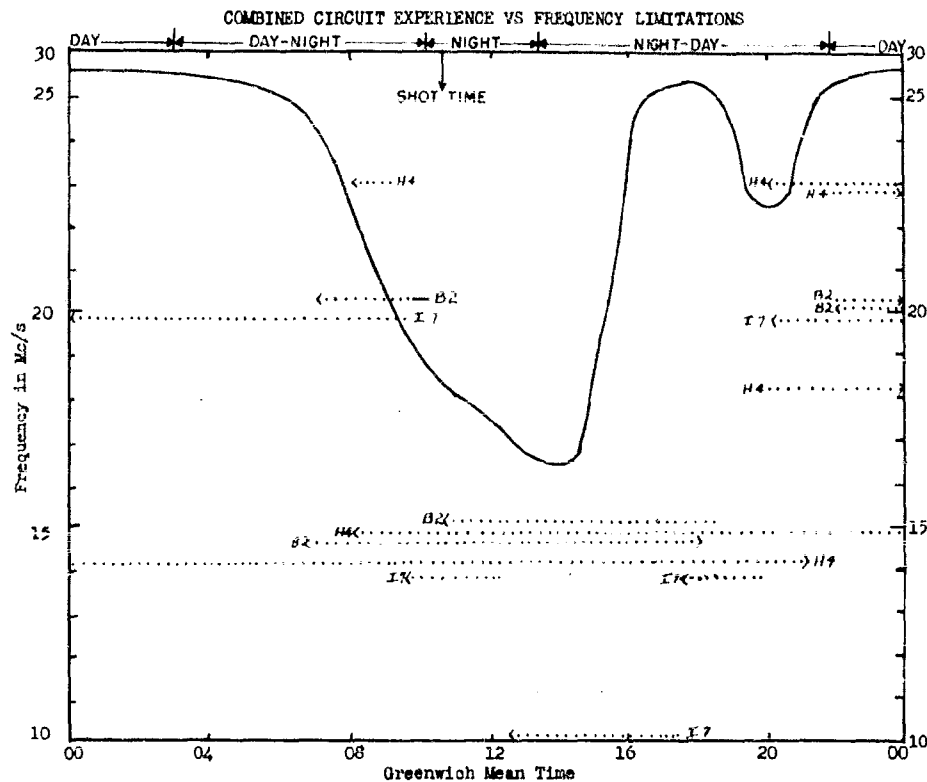


Figure 150

**SECRET**  
312

# SECRET

## KEY TO COMBINED CIRCUIT EXPERIENCE CHART

Circuit Experience:

Satisfactory.....  
Unsatisfactory.....

Entry of Satisfactory refers to periods of reported successful reception. Entry of Unsatisfactory refers to periods of reported outage definitely attributed to propagation conditions. All other interruptions or unreported periods result in omission of entry.

Arrowheads on circuit bars indicate direction of traffic flow. Arrow directed to left signifies reception by the first terminal mentioned on chart heading.

Length of bar corresponds to duration of circuit condition.

Data Identification Code:

Receiving Agency	Type of Service	User's Designation
A = ACAN	1 = RDB	(1) - Circuit #1
B = AT&T	2 = Speech	(2) - Circuit #2
C = US NAVY	3 = CS RTT	(3) - Circuit #3
D = CAA	4 = MOD 4-sh	(4) - Circuit #4
E = AACS	7 = 2 ch RTT	
F = RCA		
G = Mackay Radio		
H = Globe Radio		

Frequency Limitation: Predicted Monthly Median MF: (applies to undisturbed days within a 10 day period centered on test)

## KEY TO CIRCUIT CAPABILITY CHART

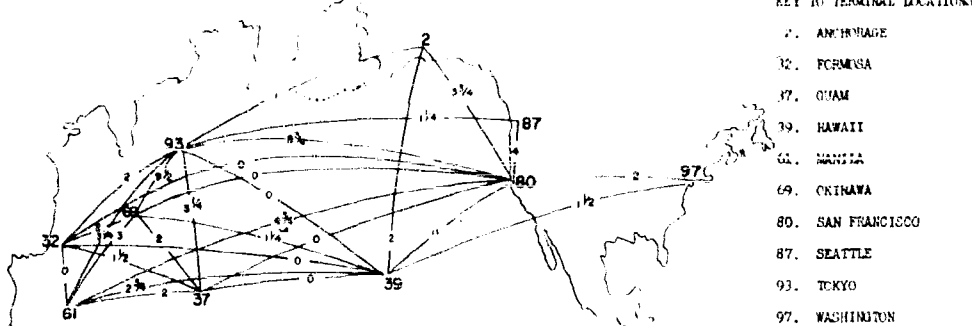
Upper Solid Curve: Capability of circuit under conditions of multiple parallel relay in frequency-hours per hour

Lower Solid Curve: Capability of circuit with no parallel relay in frequency-hours per hour

Dotted Curve: Total frequency-hours attempted per hour

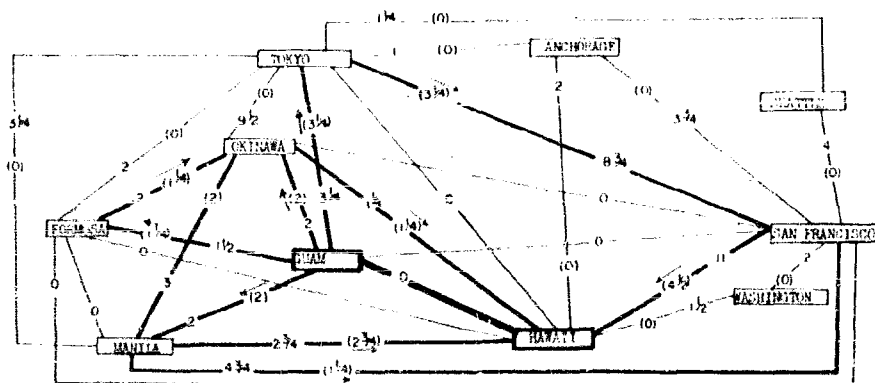
## MULTIPLE PARALLEL RELAYING AT 2000' BETWEEN GUAM AND HAWAII ON 10 AUGUST 1964

Location and performance of relay network links.



## Relay network diagram showing contributions of individual links.

Numbered arrows indicate direction and magnitude of individual contributions to relaying when all traffic is assumed to originate at Manila. All capabilities and contributions are in frequency hours.



SECRET

# **SECRET** **INCREASED CIRCUIT CAPABILITIES** **FROM** **ASSUMPTION OF MULTIPLE RELAYING**

12 August 1958

Guam-----Hawaii

Key on Page 313

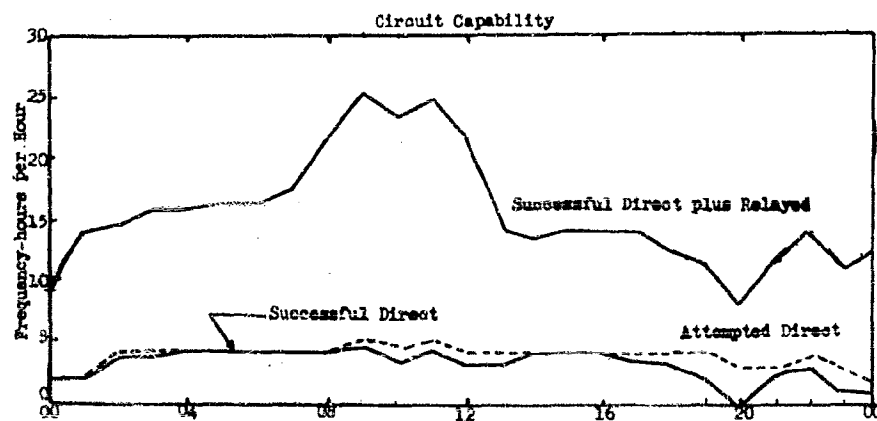
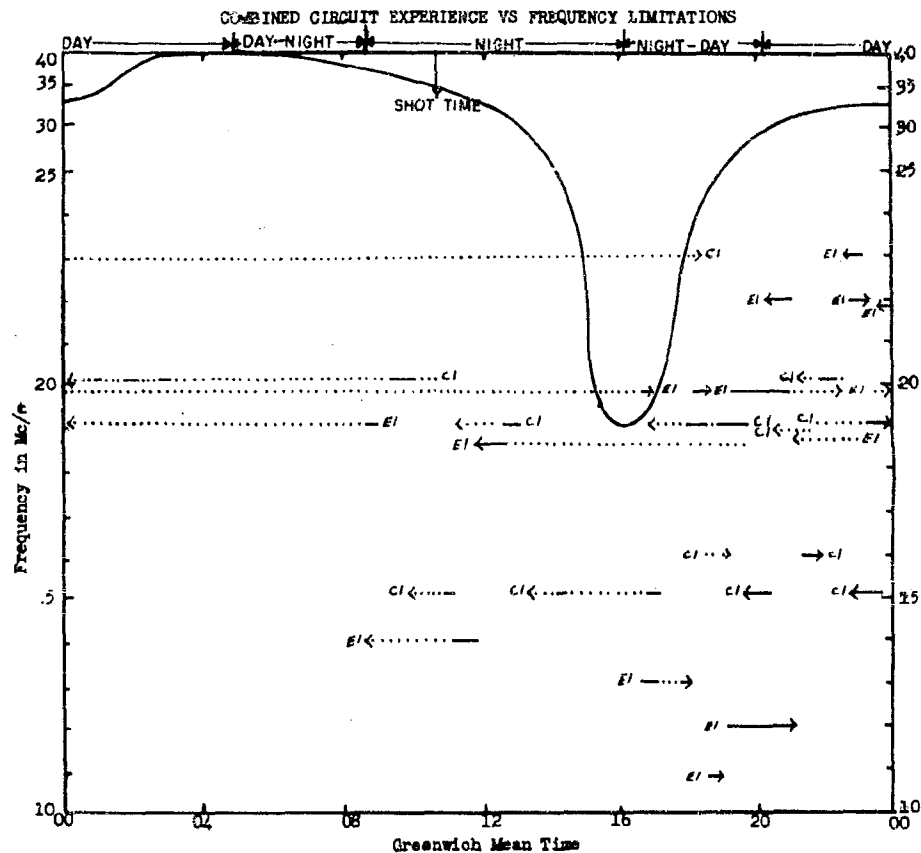


Figure 152

**SECRET**

# SECRET

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Commandant, U. S. Marine Corps, Washington 25, D. C. ATTN: Code A03H  
(Cys 93A-96A)  
Commanding Officer, U. S. Naval CIC School, U. S. Naval Air Station,  
Glynco, Brunswick, Georgia (Cy 97A)

Assistant for Atomic Energy, Headquarters United States Air Force,  
Washington 25, D. C., ATTN: DCS/O (Cy 98A)  
Assistant Chief of Staff Intelligence, Headquarters United States Air  
Force, Washington 25, D. C., ATTN: AFCIN-IB2 (Cys 99A-100A)  
Director of Research and Development, Headquarters United States Air  
Force, Washington 25, D. C., ATTN: Lt Colonel David R. Jones (Cy 101A)  
Director of Research and Development, Headquarters United States Air  
Force, Washington 25, D. C., ATTN: Guidance & Weapons Division  
(Cys 102A-112A)  
Director of Communications--Electronics, Headquarters, United States  
Air Force, Washington 25, D. C., ATTN: Lt Colonel Jamie L. Wicker  
(Cy 113A)

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Headquarters United States Air Force (AFTAC), Washington 25, D. C.,  
ATTN: Lt Col Leles (Cy 114A)  
Assistant for Operations Analysis, Headquarters United States Air  
Force, Washington 25, D. C., ATTN: Mr. Frederick R. Gracely (Cy 115A)  
Commander-in-Chief, Strategic Air Command, Offutt Air Force Base,  
Nebraska, ATTN: OAWS (Cy 116A)  
Commander, Tactical Air Command, Langley Air Force Base, Virginia,  
ATTN: Doc Security Branch (Cy 117A)  
Commander, Air Defense Command, Ent Air Force Base, Colorado, ATTN:  
Atomic Energy Division, ADLAN-A (Cy 118A)  
Commander, Air Research and Development Command, Washington 25, D. C.,  
ATTN: Mr. John J. Hobson (Cy 119A)  
Commander, Air Research and Development Command, Washington 25, D. C.,  
ATTN: Lt Colonel R. E. Fontana (Cy 120A)  
Commander, Air Research and Development Command, Washington 25, D. C.,  
ATTN: RDRWA (Cy 121A)  
Commander, Air Force Ballistic Missile Division, Headquarters AFMDC, Air  
Force Unit Post Office, Los Angeles 45, California, ATTN: WDSOT (Cy 122A)  
Commander, Air Force Cambridge Research Center, L. G. Hanscom Field,  
Bedford, Massachusetts, ATTN: Dr. Philip Newman (Cy 123A)  
Commander, Air Force Cambridge Research Center, L. G. Hanscom Field,  
Bedford, Massachusetts, ATTN: CRQST-2 (Cys 124A&125A)  
Commander, Air Force Cambridge Research Center, L. G. Hanscom Field,  
Bedford, Massachusetts, ATTN: Dr. Oliver (Cy 126A)  
Commander, Air Force Cambridge Research Center, L. G. Hanscom Field,  
Bedford, Massachusetts, ATTN: Mr. Samuel Horowitz (Cy 127A)  
Commander, Air Force Special Weapons Center, Kirtland Air Force Base,  
New Mexico, ATTN: Lt H. K. Lonsdale (Cy 128A)  
Commander, Air Force Special Weapons Center, Kirtland Air Force Base,  
New Mexico, ATTN: Technical Info and Intelligence Division  
(Cys 129A-131A)  
Director, Air University Library, Maxwell Air Force Base, Alabama  
(Cys 132A&133A)  
Commander, Air Force Special Weapons Center, Kirtland Air Force Base,  
New Mexico, ATTN: Lt Roland F. Prater (Cy 134A)  
Commander, Lowry Air Force Base, Denver, Colorado, ATTN: Dept of Special  
Weapons Training (Cy 135A)  
Commander, 1009th Special Weapons Squadron, Headquarters United States  
Air Force, Washington 25, D. C. (Cy 136A)  
Commander, Wright Air Development Center, Wright-Patterson Air Force  
Base, Ohio, ATTN: Mr. Ludlow B. Hallman, Jr. (Cy 137A)  
Commander, Wright Air Development Center, Wright-Patterson Air Force  
Base, Ohio, ATTN: WCOSI (Cys 138A-140A)  
Director, USAF Project RAND Via Air Force Liaison Office, 1700 Main  
Street, Santa Monica, California (Cys 141A-143A)  
Deputy Chief of Staff, Operations, Headquarters United States Air Force,  
Washington 25, D. C., ATTN: Opns Analysis (Cy 144A)

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Commander, Air Defense Systems Integration Division, L. G. Hanscom Field,  
Bedford, Massachusetts, ATTN: SIDE J (Cy 145A)  
Chief, Ballistic Missile Early Warning Project Office, 220 Church Street;  
New York 13, New York, ATTN: Colonel Leo V. Skinner, USAF (Cy 146A)  
Director of Defense Research & Engineering, Washington 25, D. C., ATTN:  
Technical Library (Cy 147A)  
Director, Weapons Systems Evaluation Group, OSD, Room 2E1006, The  
Pentagon, Washington 25, D. C. (Cy 148A)  
U. S. Documents Officer, Office of the United States National Military  
Rep, SHAPE, APO 55, New York, New York (Cy 149A)  
Director, Advanced Research Projects Agency, Washington 25, D. C.,  
ATTN: F. A. Koether (Cys 150A-170A)  
Commander, Field Command, Defense Atomic Support Agency, Sandia Base,  
Albuquerque, New Mexico (Cys 171A-180A) also (Cys 353A-400A, surplus cys)  
Commander, Field Command, Defense Atomic Support Agency, Sandia Base,  
Albuquerque, New Mexico, ATTN: FCWT (Cys 181A-185A)  
Commander, Field Command, Defense Atomic Support Agency, Sandia Base,  
Albuquerque, New Mexico, ATTN: FCTG (Cy 186A)  
Commander, Field Command, Defense Atomic Support Agency, Sandia Base,  
Albuquerque, New Mexico, ATTN: FCOD-4 (Cy 187A)  
Army Security Agency, Arlington Hall Station, Arlington 12, Virginia,  
FOR: Mr. A. A. Small, Mr. Richard Neil, Capt Russell Jones, LtColonel  
Philip Finney and Mr. William Moran (Cys 188A-192A)  
Commander, USAF Security Service, San Antonio, Texas, FOR: SCE; SCP; SCT;  
ODC; ETC; 6900th Sec Wing; 6920th Sec Wing; 6981st Sec Wing, RGM;  
6901st Sec Wing, SCG; 6902d Sec Wing, SCG (Cys 193A-202A)  
Army Security Agency Training Center, Fort Devens, Massachusetts,  
ATTN: Colonel Fairchild (Cys 203A-207A)  
Chief of Naval Operations, Navy Department, Washington 25, D. C.,  
ATTN: OP 300, GHO (Cys 208A-217A)  
National Security Agency, Fort George G. Meade, Maryland, ATTN: REMF  
(Cys 218A-237A)  
Commander-in-Chief, U. S. Pacific Fleet, Navy No. 128, Fleet Post Office  
San Francisco, California, ATTN: Brig Gen Edward A. Montgomery, USMC  
(Cy 238A)  
Chief, Joint Atomic Information Exchange Group, Defense Atomic Support  
Agency, Washington 25, D. C. (Cys 239A-248A)  
Director of Development Planning, Headquarters USAF, Washington 25, D.C.,  
ATTN: AFDAP-W, Colonel W. H. Earle (Cy 249A)  
Deputy Chief of Staff, Operations, Headquarters USAF, Washington 25,  
D. C., ATTN: OA (Cy 250A)  
Assistant Secretary (Supply & Logistics), Washington 25, D. C.,  
ATTN: Mr. M. R. Dunaj, OSD S&L (Cys 251A&252A)  
Commander, U. S. Army Communications Agency, Washington 25, D. C.,  
ATTN: SIGCA-4 (Cy 253A)

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Deputy Chief of Staff, Operations, Headquarters USAF, Washington, D.C., ATTN: Air Traffic Control (Cy 254A)  
Commander, Air Force Cambridge Research Center, Lincoln, Mass., ATTN: SIGE (Cys 255A & 256A)  
Commander, Eighth Air Force, USAF, Westover Air Force Base, Westover, Mass., ATTN: OA (Cy 257A)  
Commander-in-Chief, Strategic Air Command, Offutt Air Force Base, Nebraska, ATTN: DINC (Cy 259A)  
Assistant to the Secretary of Defense (Atomic Energy), Washington, D.C. (Cy 259A)  
Commanding General, U.S. Army Electronic Proving Ground, Ft. Huachuca, Arizona, ATTN: SIGPG-DEIA (Cy 260A)  
Chief Signal Officer, Department of the Army, Washington, D.C., ATTN: SIGCO-3-b (Cy 261A)  
Commander-in-Chief, U.S. Air Forces in Europe, APO 12, New York, ATTN: OA (Cy 262A)  
Commander, ASTIA, Arlington Hall Station, Arlington Hall, Va., ATTN: TIPDR (Cys 263A-312A)  
Chief, Defense Atomic Support Agency, Washington 25, D.C.

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**Defense Threat Reduction Agency**

45045 Aviation Drive  
Dulles, VA 20166-7517

May 10, 1999

MEMORANDUM TO DEFENSE TECHNICAL INFORMATION CENTER  
ATTN; OCQ/MR WILLIAM BUSH

SUBJECT: DOCUMENT REVIEW

The Defense Threat Reduction Agency's security office has reviewed and declassified the following documents:

AFSWP-1104, AD-313420 @ NTIS Dist. not chged  
DASA-1444, AD-347629  
DASA-1460, AD-362824 SFRD  
DASA-1240-CH-9-SEC-9.5, AD-354626  
DASA-1240-CH-9-P-2-SEC-9.3, AD-346387 S-FRD  
DASA-1240-CH-3-P-2-SEC-3.2, AD-367872 C-FRD  
DASA-1240-CH-5-P-2-SEC-5.2, AD-365500 C-FRD  
DASA-1240-CH-9-P-2-SEC-9.4, AD-346603 SFRD  
DASA-1504-3, AD355637  
DNA-3051F-2, AD-528106  
DNA-2790F, AD-519052  
DNA-3069F, AD-525446  
DNA-3291F-2, AD-530064

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These documents were reviewed under the Executive  
Order 12958.

*Arndith Jarrett*  
ARDITH JARRETT  
Chief, Technical Resource Center